Personality characteristics and self-reported oral health

Hadeel Ibrahim

A thesis submitted for the degree of

Doctor of Clinical Dentistry in Prosthodontics

At the University of Otago, Dunedin,

New Zealand
This thesis is dedicated to the best gift that God has given me

My two children,

Ahmad and Yasmeen

March on. Do not tarry.

To go forward is to move toward perfection.

March on, and fear not the thorns,

or the sharp stones on life's path.

Khalil Gibran
Abstract

Background

Research has shown that a link exists between certain psychological traits and subjective (that is, self-assessed) health. Recent work in health psychology has clearly associated health perceptions with personality characteristics, most notably with the negative emotionality dimension of personality. The degree to which this personality trait influences self-reported oral health is yet to be determined. This study investigated the influence of personality on subjective oral health.

People with certain personality traits (specifically negative emotionality) tend to rate their own health differently to others. Oral health is no exception to this. Those who ”view the glass as half empty” are more likely to be more distressed and unsatisfied with any given situation or state; they also tend to amplify negative experiences, and view the negative side of the world, others, and themselves. The degree to which this personality trait influences self-reported oral health is yet to be determined.

In New Zealand, findings from the Dunedin Multidisciplinary Health and Development Study suggested that personality characteristics have an effect on the way individuals perceive their oral health (Thomson et al., 2011a). Investigating the relation between personality and oral health will assist in understanding a public health burden, since substantially more dental visits could be expected from people with these characteristics.

This study looked at the role of personality as a modifying factor when subjective oral health measures are being investigated.

Objectives

The objectives of this study were to:

1. Describe the prevalence of xerostomia and dental anxiety, and determine their influence on OHRQoL;
2. Investigate the association of personality characteristics with OHRQoL, xerostomia, and dental anxiety;
3. Test the validity of using a short personality scale (the PANAS) alongside other measures of oral health; and
(4) Test the validity of a new dental anxiety measure (the IDAF-4C) in New Zealand.

**Methods**
A cross-sectional study of a representative adult New Zealand sample was undertaken. The questionnaire was mailed to 523 randomly-selected participants. The questionnaire was sent with the cover letter, information sheet, and a free-post envelope. The cover letter requested that the participant be able to read and answer the provided questionnaire and was in the target age range for the study, which was 35-54 years. Data were collected on socio-demographic characteristics, oral and general health care, oral health-related quality of life (OHRQoL), xerostomia, dental anxiety, and the personality characteristics of positive and negative affect (PA and NA, respectively). A total of 253 questionnaires were completed and returned, yielding a 51.8% response rate.

**Results**
The prevalence of xerostomia was 7.8%. More than half of those with xerostomia reported one or more OHIP-14 impacts “often” or “very often”. The prevalence rates for dental anxiety were 18.6% using the DAS (cut-off point 13), and 13.0% using the IDAF-4C (cut-off point 3). The overall prevalence of 1+ OHIP-14 impacts was 24.1%, while the mean OHIP-14 score was 10.8 (SD=8.1). The highest and most prevalent subscale impacts were those pertaining to psychological discomfort.

Those scoring higher on Negative Emotionality were more likely to report 1+ OHIP-14 impacts. They also had a greater risk of reporting xerostomia or dental anxiety.

There was support for the validity of the IDAF-4C in its associations with not only the DAS scores, but also with the various aspects of dental visiting and self-reported oral health.

**Conclusion**
Responses to self-report measures can be influenced by particular personality traits. Therefore, it is important to consider this when using and interpreting such measures.
Acknowledgement

First of all, I am grateful to God, for always giving me the strength to keep going.

I would like to thank the Fuller Scholarship for their financial support of this project.

I owe deep-felt gratitude to Professor Murray Thomson. Without his stimulating motivation and expert guidance, I could not have completed this work. I sincerely thank all my other supervisors, Professor Karl Lyons, Dr. Lyndie Foster-Page, and Ms. Suzanne Hanlin, for providing me with invaluable assistance throughout my academic program. I especially express my genuine appreciation to Professor Karl Lyons for his unceasing encouragement and support.

I would also like to thank David Purton and Dr Lyndie Foster-Page for believing in me and encouraging me to pursue this degree.

To my family, my Mum and three brothers. Their endless love and support made this thesis possible. To my lovely children Ahmad and Yasmeen, for enduring Mum’s late study nights, bedtime without “Mama”, and the many “can you give me another hour to work on something” moments. To all my friends, I will not name each and everyone of you; I am grateful to have the love of such great people in my life. Yet a special thanks goes to my best friend Iman Nimer, who lent a sympathetic ear when I needed it most and encouraged me throughout this journey.
# Table of Contents

Contents

Abstract .......................................................................................................................... iii

Acknowledgement ........................................................................................................ v

Table of Contents ......................................................................................................... vi

List of Figures .............................................................................................................. ix

List of Tables .............................................................................................................. x

Chapter I: Introduction ............................................................................................... 1
  1.1 Introduction ........................................................................................................ 1
  1.2 Rationale for the study .................................................................................... 1
  1.3 Aims and objectives ....................................................................................... 2
  1.4 Research questions ......................................................................................... 2
  1.5 Thesis lay-out .................................................................................................. 3

Chapter II: Literature Review ...................................................................................... 4
  2.1 Introduction ..................................................................................................... 4
  2.2 Health Related Quality of Life and OHRQoL concepts .................................... 4
      2.2.1 OHRQoL instruments ........................................................................... 7
      2.2.2 Relation between oral health status, general QoL, and OHRQoL .......... 12
      2.2.3 Overview of the literature on OHRQoL ............................................... 13
  2.3 Xerostomia ...................................................................................................... 14
      2.3.1 Background .......................................................................................... 14
      2.3.2 Xerostomia in relation to salivary gland hypofunction ....................... 14
      2.3.3 Prevalence of xerostomia ................................................................... 16
      2.3.4 Xerostomia and oral health .................................................................. 17
      2.3.5 Xerostomia and OHRQoL .................................................................. 18
      2.3.6 Aetiology of xerostomia ..................................................................... 19
      2.3.7 Measuring xerostomia .......................................................................... 19
      2.3.8 An overview of the literature on xerostomia ....................................... 21
  2.4 Dental Anxiety .................................................................................................. 22
      2.4.1 Background .......................................................................................... 22
      2.4.2 Dental anxiety: epidemiology ............................................................... 22
      2.4.3 Consequences of dental anxiety ............................................................ 23
      2.4.4 Dental anxiety and OHRQoL ................................................................. 24
      2.4.5 Dental anxiety Aetiology ..................................................................... 25
      2.4.6 Measures of dental anxiety .................................................................. 31
      2.4.7 Dental anxiety treatment ...................................................................... 35
      2.4.8 An overview of the literature on dental anxiety .................................... 36
  2.5 Negative affectivity ......................................................................................... 36
      2.5.1 Introduction .......................................................................................... 36
Chapter III: Methods ................................................................. 42
3.1 Introduction ............................................................................. 42
3.2 Study design ........................................................................... 42
3.3 The sample ............................................................................. 42
3.4 Māori consultation, ethical approval, and informed consent ....... 43
3.5 Questionnaire design ............................................................... 43
3.5.1 Socio-demographic characteristics ..................................... 43
3.5.2 Oral and general health care variables ................................. 44
3.5.3 Oral health impact variables .............................................. 45
3.5.4 Instruments investigating xerostomia ................................. 45
3.5.5 Scales investigating dental anxiety ..................................... 45
3.5.6 Scale investigating positive affect and negative affect ......... 46
3.6 Data collection and confidentiality .......................................... 46
3.7 Statistical analyses ................................................................. 47
3.7.1 Dependent variables ............................................................ 47
3.7.2 Data analysis ........................................................................ 47
3.7.3 Missing data ......................................................................... 48

Chapter IV: Results ..................................................................... 49
4.1 Socio-demographic characteristics ........................................ 49
4.1.1 Participation details ............................................................ 49
4.1.2 Respondents’ characteristics ............................................. 50
4.1.3 Sample description ............................................................. 51
4.2 Oral care characteristics ........................................................ 52
4.2.1 Time since last dental visit ................................................ 52
4.2.2 Association between usual reason for visit and last dental visit 53
4.2.3 Brushing frequency and smoking ....................................... 54
4.3 Self-reported oral health ........................................................ 55
4.3.1 Self-reported oral health by socio-demographic characteristics 55
4.3.2 Self-reported oral health by oral care characteristics .......... 56
4.4 Oral health-related quality of life (OHRQoL) ......................... 58
4.4.1 Prevalence and severity of OHIP-14 total impacts by socio-demographic characteristics ........................................ 58
4.4.2 Prevalence and severity of OHIP-14 subscale/domain impacts .................................................................................. 59
4.4.3 Prevalence of OHIP-14 subscale/domain impacts by socio-demographic characteristics .............................................. 59
4.4.4 Mean subscale OHIP-14 scores by socio-demographic characteristics ................................................................. 61
4.5 Self-reported xerostomia ........................................................ 63
4.5.1 Validity of the Summated Xerostomia Inventory (SXl) ........ 63
4.5.2 Self-reported xerostomia by socio-demographic characteristics .................................................................................. 64
4.5.3 Association of xerostomia with oral-health-related-quality-of-life (OHRQoL) ............................................................. 65
4.6 Dental anxiety ........................................................................ 68
4.6.1 Confirmatory factor analysis (CFA) for the DAS .................. 68
4.6.2 Exploratory factor analysis (EFA) for IDAF-4C....................... 69
4.6.3 Individual responses to dental anxiety scales (the DAS and the IDAF-4C) ........................................ 69
4.6.4 Validity of the IDAF-4C ................................................................................................................. 70
4.6.5 Prevalence of dental anxiety ........................................................................................................... 73
4.6.6 Mean DAS and mean IDAF-4C scores by socio-demographic characteristics ............................... 75
4.6.7 Association between dental anxiety and OHRQoL ........................................................................ 76
4.7 Positive affect (PA) and negative affect (NA) .................................................................................... 78

4.7.1 Confirmatory factor analysis (CFA) for the PANAS ...................................................................... 78
4.7.2 The relation between the PANAS PA and PANAS NA ................................................................. 79
4.7.3 Mean PANAS scores by socio-demographic characteristics .......................................................... 80

4.8 Regression models ................................................................................................................................. 80

4.8.1 Logistic regression model for the prevalence of 1+ OHIP-14 impacts .......................................... 81
4.8.2 Negative binomial regression model for the mean OHIP-14 total score ....................................... 82
4.8.3 Logistic regression model for dental anxiety (as defined by IDAF-4C) ........................................ 83
4.8.4 Negative binomial regression model for IDAF-4C ......................................................................... 84

Chapter V: Discussion ................................................................................................................................. 85

5.1 Overview ............................................................................................................................................... 85

5.2 Methodological issues ............................................................................................................................ 86

5.2.1 Study design .................................................................................................................................. 86
5.2.2 Response rate .................................................................................................................................. 86
5.2.3 Sample representativeness .............................................................................................................. 88

5.3 Oral care and self-care characteristics ................................................................................................ 90

5.3.1 Dental visiting patterns .................................................................................................................. 90
5.3.2 Self-care ........................................................................................................................................ 90
5.3.3 Tobacco use characteristics .......................................................................................................... 91

5.4 Research questions ................................................................................................................................. 91

5.4.1 What evidence is there for the validity of the scales used in this study? ........................................ 91
5.4.2 What is the prevalence of xerostomia and how does it differ by socio-demographic and personality characteristics? ...................................................................................................................... 93
5.4.3 Is xerostomia associated with people’s self-reported oral health and do aspects of personality influence that association? ...................................................................................................................... 94
5.4.4 What is the prevalence of dental anxiety and how does it differ by socio-demographic and personality characteristics? ................................................................................................................................. 94
5.4.5 Is dental anxiety associated with people’s self-reported oral health and do aspects of personality influence that association? .............................................................................................................. 96
5.4.6 Is the IDAF-4C a more valid way than the DAS to measure dental anxiety? ................................. 97

Chapter VI: Conclusions .............................................................................................................................. 99

References .................................................................................................................................................... 101

Appendices .................................................................................................................................................... 128

Appendix A: Map of the Dunedin South Electorate Boundaries ................................................................. 128
Appendix B: Letter from Ngāi Tahu .............................................................................................................. 129
Appendix C: Letter of ethical approval ......................................................................................................... 131
Appendix D: Introductory sheet .................................................................................................................... 133
Appendix E: Information sheet for participants .......................................................................................... 134
Appendix F: The study questionnaire .......................................................................................................... 136
Appendix G: Individual responses to the dental anxiety scales (IDAF-4C and DAS) .............................. 145
List of Figures

Figure 2.1 Conceptual model for measuring oral health (Locker, 1988) ...............................5
Figure 2.2. Link between clinical variables and quality of life (Wilson and Cleary, 1995) ..... 6
Figure 2.3 The vicious cycle of dental anxiety (Berggren and Meynert, 1984).....................29
Figure 4.1 Scatter plot for the IDAF-4C and the DAS ..........................................................70
Figure 4.2 Scatter plot for PANAS PA and PANAS NA ..........................................................79
List of Tables

Table 2.1. Most commonly used dental anxiety measures .......................................................... 32
Table 4.1 Participation in the study ................................................................................................................. 49
Table 4.2 Respondents’ characteristics by age group, ethnicity, and gender (brackets contain percentages unless otherwise indicated) .................................................................................................. 50
Table 4.3 Participants’ socio-demographic characteristics (brackets contain percentages unless otherwise indicated) ..................................................................................................................... 51
Table 4.4 Time since last dental visit by socio-demographic characteristics (brackets contain percentages unless otherwise indicated) .................................................................................................. 52
Table 4.5 Associations between dental visiting patterns and time since last dental visit (brackets contain percentages unless otherwise indicated) .............................................................................. 53
Table 4.6 Brushing frequency and smoking status by socio-demographic characteristics (brackets contain percentages unless otherwise indicated) .............................................................................. 54
Table 4.7 Self-reported oral health by socio-demographic characteristics (brackets show percentages unless otherwise indicated) ........................................................................................................ 55
Table 4.8 Self-reported oral health by dental care characteristics (brackets show percentages unless otherwise indicated) ............................................................................................................................... 57
Table 4.9 Severity and prevalence of OHIP-14 impacts by socio-demographic characteristics .......................................................................................................................................................... 58
Table 4.10 Prevalence and severity of impacts by OHIP-14 subscale .............................................................. 59
Table 4.11 Prevalence of subscale OHIP-14 impacts (‘often’ or ‘very often’) by socio-demographic characteristics (brackets contain percentages unless indicated) .............................................. 60
Table 4.12 Mean OHIP-14 scores by socio-demographic characteristics (brackets contain standard deviations unless otherwise indicated) .................................................................................... 62
Table 4.13 Mean SXI scores by standard xerostomia question response categories and by xerostomia status ..................................................................................................................................................... 63
Table 4.14 Self-reported xerostomia status and severity by socio-demographic characteristics (brackets contain percentages unless otherwise indicated) .............................................................. 64
Table 4.15 Prevalence of 1+ overall OHIP-14 impacts by xerostomia status (brackets contain percentages unless otherwise indicated) ...................................................................................................... 65
Table 4.16 Prevalence of 1+ OHIP-14 subscale impacts (‘very often or ‘fairly often’) by xerostomia status (brackets contain percentages unless otherwise indicated) .............................................. 66
Table 4.17 Mean overall and subscale OHIP-14 scores by xerostomia status (brackets contain percentages unless otherwise indicated) ................................................................. 67

Table 4.18 CFA for the DAS........................................................................................................... 68

Table 4.19 CFA for the IDAF-4C .................................................................................................. 69

Table 4.20 Dental visiting patterns by dental anxiety prevalence (brackets contain percentages unless otherwise indicated) .................................................................................. 71

Table 4.21 Mean DAS and IDAF scores by dental visiting patterns ............................................. 72

Table 4.22 Concordance between the DAS and the IDAF-4C in respect of dental anxiety prevalence (brackets contain total percentages unless otherwise indicated) ................. 73

Table 4.23 Prevalence of dental anxiety (using DAS, and IDAF-4C), by socio-demographic characteristics (brackets contain percentages unless otherwise indicated) ...................... 74

Table 4.24 Mean DAS and mean IDAF scores by socio-demographic characteristics.............. 75

Table 4.25 Mean total OHIP-14 scores by dental anxiety status................................................ 76

Table 4.26 Prevalence of 1+ OHIP-14 total and subscale impacts (‘very often or ‘fairly often’) by dental anxiety status (brackets contain percentages unless otherwise indicated) .................................................................................. 77

Table 4.27 Outcome of the confirmatory factor analysis for PANAS .......................................... 78

Table 4.28 Mean PA and NA scores by socio-demographic characteristics................................ 80

Table 4.29 Logistic regression model for 1+ OHIP-14 impacts. .................................................. 81

Table 4.30 Negative binomial regression model for OHIP-14 score .......................................... 82

Table 4.31 Logistic regression model for dental anxiety .............................................................. 83

Table 4.32 Negative binomial regression model for IDAF-4C continuous score ....................... 84

Table 5.1 Gender distribution for the current study, DSE, DMS, and New Zealand...................... 88

Table 1.2 Ethnicity data for the current study, DSE, DMS, and New Zealand .......................... 89

Table 1.3 Considering the validity of the IDAF-4C in the current study ...................................... 98
Chapter I: Introduction

1.1 Introduction

The connection between the human psyche and health has long intrigued healthcare researchers; many studies have looked at the effects of the mind on health (Watson and Pennebaker, 1989). Research has shown that the effect of the psychological state on the objective health state is still controversial, but the effect on subjective (that is, self-assessed) health is conclusive (Costa and McCrae, 1987). An appreciable body of literature on health psychology clearly associates personality with health (Watson and Pennebaker, 1989). This association is most evident for the negative emotionality dimension of personality (Friedman and Booth-Kewely, 1987; Abas et al., 2002; Mroczek et al., 2009).

Of the common conditions that affect oral health, dental anxiety and xerostomia merit special attention. Dental anxiety poses a public health problem (Mehrstedt et al., 2007); management for this condition is still challenging despite extensive research into possible aetiologies (Meng et al., 2007). Furthermore, the prevalence rates for dental anxiety have not declined despite technological advancements in dentistry. Moreover, people’s well-being may significantly be affected by xerostomia and/or dental anxiety (Thomson et al., 2006; Vermaire et al., 2008). Of the wide range of factors implicated in the aetiology of the two conditions, personality is of special interest. Because both conditions are considered subjective states (that is, they are influenced by people’s evaluation of the condition), it has been suggested that patients’ reports of these two conditions are affected by personality (Thomson et al., 2006; Vassend et al., 2011). It is therefore important to evaluate the role of personality as a modifying factor when subjective oral health measures are being investigated.

1.2 Rationale for the study

Although there have been studies investigating the association of personality characteristics with oral health (Thomson et al., 2011a), no studies specifically looked at the extent that these characteristics are likely to modify self-reports of oral health.

Oral health self-reports may be “contaminated” by certain personality traits, especially those falling under the negative emotionality dimension of personality (the disposition to experience
aversive emotional states). Confirmation of the relation between negative emotionality and health will assist in understanding a public health burden, because significantly more medical and dental visits could be expected from people with such personality characteristics.

People who tend to exaggerate their disease status put a disproportionate and unnecessary drain on health resources (Costa and McCrae, 1987). Furthermore, healthcare researchers need to be aware that, when people’s views of their own health are coloured by their personality, overestimation of the prevalence of poor oral health may result (Thomson et al., 2011a). It is therefore important to know the degree of association between certain personality characteristics and oral health. This research will make an important contribution. It will be the first to incorporate a personality questionnaire concurrently with patient oral health reports. Furthermore, personality-health research is gaining increasing attention; preliminary research suggests that personality-related interventions may be promising in improving health (Greenberg, 2006).

### 1.3 Aims and objectives

The aims and objectives of the study were:

1. To describe self-reported OHRQoL and its associations in a randomly selected New Zealand adult sample;

2. To determine whether personality influences the reporting of OHRQoL;

3. To describe the prevalence of xerostomia in the adult New Zealand population, its relation to OHRQoL and negative whether negative emotionality influences self-reports of xerostomia;

4. To investigate the relation between dental anxiety and OHRQoL; and

5. To determine whether negative emotionality influences reports of dental anxiety.

### 1.4 Research questions

The research questions to be answered in the current study were:

1. What evidence is there for the validity of the scales used in this study?
2. What is the prevalence of xerostomia and how does it differ by socio-demographic and personality characteristics?

3. Is xerostomia associated with people’s self-reported oral health (OHIP-14, Locker’s global item) and do aspects of personality influence that association?

4. What is the prevalence of dental anxiety and how does it differ by socio-demographic and personality characteristics?

5. Is dental anxiety associated with people’s self-reported oral health and do aspects of personality influence that association?

6. Is the IDAF-4C a more valid way than Corah’s Dental Anxiety Scale to measure dental anxiety?

1.5 Thesis lay-out

This thesis is divided into seven sections. A review of the literature follows the introductory chapter, providing the current knowledge on Oral-Health-Related Quality of Life (OHRQoL), xerostomia, and dental anxiety, before delving into the recently-researched effect of negative affectivity and its relationship with oral health. The methods chapter follows to describe the way the study was designed and executed including data manipulation. The investigation outcomes are outlined in chapter four. Chapter five discusses the study findings before making the concluding remarks in chapter six. Finally, chapter seven carries the references and the data referred to in the text before concluding with relevant appendices.
Chapter II: Literature Review

2.1 Introduction

This review of the literature provides an overview of how oral health may be influenced by personality. It defines Oral Health-Related Quality of Life (OHRQoL) and the development of the Oral Health Impact Profile (OHIP), before describing the short-form of that questionnaire. The current knowledge on xerostomia, and of dental anxiety is summarized, including discussion of prevalence and possible aetiology, and the proposed effect of each on OHRQoL. This review concludes by defining negative affectivity (NA) and exploring its relation to health in general and to oral health in particular.

2.2 Health Related Quality of Life and OHRQoL concepts

The Health-Related Quality of Life (HRQoL) concept was introduced to capture the social and functional aspects of health and disease (Wilson and Cleary, 1995). The growing interest in the HRQoL concept was mainly driven by an increasing awareness that achieving well-being can only be accomplished if health is viewed as an interaction between physical, mental, and social factors (Berzon et al., 1993), and these are interdependent and cannot be viewed in isolation of one another (Wilson and Cleary, 1995). Furthermore, the traditional objective examination has been criticised for failing to take into consideration peoples’ perspectives of their own health (Schipper, 1983). HRQoL measures were developed to complement the traditional clinical measures in assessing overall well-being and quality of life (Robinson et al., 2003). Healthcare providers have also noted the usefulness of HRQoL measures in evaluating treatment needs, planning appropriate disease prevention programmes (Locker, 1995a), and in optimising the utilisation of health resources (Fitzpatrick et al., 1992). HRQoL is a vital aspect in prioritising health research, by taking into consideration the needs and value of patients, and their families (Bakas et al., 2012).

Oral health was traditionally assessed by clinical examination of patients through excluding the presence of disease. Historically, the effects of oral conditions on peoples’ daily lives were ignored. Some of the commonly used measures in dentistry, such as the DMFT (decayed, missing, filled teeth; Klein et al., 1938), failed to link the clinical measurements to quality of
life (Locker, 1997). The need for measuring the impact of oral disease on peoples’ day-to-day living was soon recognised. This called for a psycho-social model that could take into consideration the complexity of oral health (Gift et al., 1997). Therefore, after its introduction in the general medical literature, the quality of life concept was described and studied in the dental literature (Cohen and Jago, 1976). The OHRQoL model described the need to consider the way people perceive their own oral health. Several tools have been developed to reflect on the social, emotional, and physical aspects of oral health (Cushing et al., 1986; Atchison and Dolan, 1990; Locker and Miller, 1994; Slade and Spencer, 1994; Leao and Sheiham, 1996). These measures are collectively known as OHRQoL measures (Slade, 1997a).

Cohen and Jago (1976) were the first to indicate the need for developing oral health indicators, which they called “socio-dental indicators”. Locker (1995a) suggested that social factors were as important as clinical factors in clarifying the outcomes of oral conditions. A conceptual framework model (Figure 1) was suggested by Locker (1988), based on the World Health Organization’s international classification of impairment, disability, and handicap (ICIDH; Wood, 1980). The five successive consequences of oral disease are impairment, functional limitation, pain/discomfort, disability, and handicap. Disease (for example, caries) leads to impairment which is the loss of a body part or function (for example, tooth loss), which in turn leads to disability as it interferes and limits daily activities (for example, restrictions in food choice) and as a result may lead to handicap (for example, social avoidance).

Figure 2.1 Conceptual model for measuring oral health (Locker, 1988)

The conceptual model’s strength was that it introduced a hierarchy for oral disease outcomes, and that allowed a distinction between internal and external impacts. The former impacts include functional difficulties, while the latter are those that can cause social limitations or avoidance of others (Allen, 2003).

Locker continued to review the conceptual framework model in subsequent work, as it was a theoretical model for measuring oral health, and did not specifically represent OHRQoL per se.
His view of the model was revisited, when he adapted Wilson and Cleary’s model (Figure 2) to oral health. This later model embraced disease, health, and quality of life concepts concurrently. Further, he recognised the roles that personal and environmental characteristics play in the health perception process. Locker’s work has been the basis on which most OHRQoL measures were formulated. QoL research related to oral health has burgeoned ever since Locker’s model was introduced. The model has been tested on different populations including UK and Australian samples (Nuttall et al., 2006). Although Nuttall et al. (2006) restricted its application to population studies, Baker (2007) subsequently concluded that Locker’s model was a generic one that could be applied to individuals and groups, in addition to samples.

**Figure 2.2.** Link between clinical variables and quality of life (Wilson and Cleary, 1995)

Perhaps the best application of OHRQoL measures would be their use in clinical trials, where they may provide important information on intervention outcomes (Fitzpatrick et al., 1992; Allison et al., 1997; Awad et al., 2000; Allen et al., 2001). Using OHRQoL measures routinely could prevent the situation where clinicians opt for treatments producing a better cure but a poorer functional outcome (Schipper, 1983). Instead, these measures have been employed mostly in epidemiological and health services research, and in the cost analyses of national health facilities (Sischo and Broder, 2011).

Although Locker (1997) recognized that health problems do affect the quality of life, he suggested that such an outcome is not inevitable, because people with poor health may not necessarily suffer a poor OHRQoL. The individual has the ability to accommodate to illness and the changes it brings about. This phenomenon, termed the “response shift”, refers to a change in one’s self-evaluation. This, in return, can affect a patients’ health reports in response to changes in their health status (Sprangers and Schwartz, 1999). Following a similar line of
thought, Allison et al. (1997) suggested that quality of life is a “dynamic construct” and subject to change over time. An example of this is a patient whose eating problems are important at one point in time. When later diagnosed with oral cancer and subsequently treated with radiotherapy or surgery, personal self-modification enables the patient to view the original complaint as trivial in comparison to the new situation. As a result, the patient reports fewer problems. Adaptation and coping are examples of psychological modification techniques that may help in changing an individual’s attitudes.

Further, other personal characteristics may influence QoL assessments, such as uncertainty, self-concept, optimism and self-control. These are personal characteristics that may have some aspects that are sensitive to change, and others that remain constant and it is suggested there is a need to use psychological parameters in conjunction with QoL instruments to account the influence of these psychological characteristics (Allison et al., 1997).

In summary, the models which link disease, oral health and quality of life have evolved as a result of the distinction between health and disease and the steady change in how health is defined (Locker, 1997). These factors have contributed to the emergence of numerous scales that measure oral health, and which have been employed in a wide range of applications.

### 2.2.1 OHRQoL instruments

The first measures of OHRQoL appeared in the 1980s (Cushing et al., 1986), and the field continues to develop. OHRQoL measures have been broadly divided into generic and disease-specific measures (Allen et al., 1999). Generic measures evolved for use across a wide range of diseases and conditions. Although intended initially to be used in population surveys, they were later used in clinical trials. When applied to study both healthy and diseased populations, they also proved valuable in comparisons among patients with different diseases (Patrick and Deyo, 1989). Examples of the generic measures are the Sickness Impact Profile (SIP, Bergner et al., 1981), the Nottingham Health Profile (NHP, Hunt et al., 1981) and Medical Outcomes Study 36-Item Short-Form (SF-36, Ware and Sherbourne, 1992).

The main drawbacks of generic measures are their lack of sensitivity to oral health (Allen et al., 2001), in that they are unable to reflect intervention outcomes or the impact of a specific treatment on quality of life (Patrick and Deyo, 1989; Eiser, 1997). Although recent work by Brennan has suggested otherwise (Brennan, 2013), that remains the only study to contradict the overall principle of generic measures not adequately reflecting oral health. A generic scale may
fail to detect the effects of treatments, such as xerostomia in a head and neck cancer patient following radiotherapy. Subsequently, specific measures have been developed. Their main focus was evaluating life aspects specifically affected by oral diseases or conditions. Studies have shown a greater responsiveness (the ability to detect small clinical changes) of disease-specific measures than among their generic counterparts (Patrick and Deyo, 1989; Taylor et al., 1998).

The different applications of OHRQoL instruments have been identified. The goal of any research has to be considered before a measure is chosen. Depending upon the study’s aims and design, a predictive, a descriptive, or an evaluative measure may be required. Predictive instruments are used to compare a patient’s health status against a “gold standard”. The descriptive measures are used when no gold standard is available for comparison, and are primarily used in cross-sectional studies where they aim to distinguish between different ranks of OHRQoL for different people or populations. Evaluative instruments were developed to serve as longitudinal measures (Kirshner and Guyatt, 1985). The key feature of evaluative instruments is their ability to measure change in OHRQoL over time, a property Guyatt et al. (1987) referred to as the “responsiveness” of a measure. Adequate responsiveness is considered be a critical characteristic (Allen et al., 2001). This feature enables evaluative instruments to be used as outcome measures in intervention studies (Locker et al., 2004). Locker and Allen (2002) suggested that a measure that best detects changes among different population groups may not necessarily do so with in the same individual, and vice versa. Therefore, it is recommended that the researcher is clear about the goals of the study before the instrument is chosen.

2.2.1.1 The Oral Health Impact Profile (OHIP)

The Oral Health Impact Profile (OHIP) has been described as one of the most sophisticated (and perhaps the most widely used) instruments for measuring OHRQoL (Locker, 1995b). A disease-specific measure developed by Slade and Spencer (1994), it was based on the World Health Organization’s International Classification of Impairments, Disability, and Handicaps (ICIDH) model of disease and its consequences. The OHIP was developed from a set of in-depth qualitative patient interviews. More than 500 statements describing the impact of oral conditions were derived from that work. The statements were then subjected to extensive editing. The final form of the measure comprised 49 items representing the social impact of oral conditions in seven dimensions (functional limitation, physical pain, psychological
discomfort, physical disability, psychological disability, social disability, and handicap; Slade, 1997). The OHIP has been used for a number of applications, including descriptive population studies (Locker and Slade, 1993; Slade et al., 1996) and clinical trials to assess intervention outcomes (Awad et al., 2000; Allen and McMillan, 2003). Lawrence et al. (2008) suggested that using self-reported oral health measures helps to identify oral conditions that are most likely to have a negative impact on quality of life. Such a distinction allows direction of health resources towards these conditions, especially in times of limited funding and economic crisis, as we are currently experiencing worldwide.

In the same context, a wide range of factors have been studied using the OHIP in order to evaluate their influence on OHRQoL. These include socio-economic status, dental attendance, xerostomia, and dental anxiety. Poorer OHRQoL was reported in patients suffering periodontal disease, toothache, and a greater number of decayed teeth (Gooch et al., 1989). Higher OHIP score have been reported in cases of xerostomia (Matear et al., 2006; Thomson et al., 2006) and dental anxiety (Mehrstedt et al., 2007; Schierz et al., 2008).

The OHIP has also been used, although sparingly, in randomised clinical trials to assess patient outcomes in patients receiving dental treatment. The most renowned, of these studies, measured the improvement in subjective oral health in patients receiving a mandibular implant overdenture opposing a conventional maxillary denture (Awad et al., 2000). Using the OHIP, the study demonstrated a positive effect of this treatment modality on the improvement in OHRQoL; where the implant group had large decreases in the OHIP scores, when compared to controls.

2.2.1.2 Shortening OHRQoL measures

Concise forms of oral health measures were needed because they are more practical and easier to use (Coste et al., 1997), and they require less time to complete (Slade, 1997b). Several problems were encountered with lengthy questionnaires. Questions were left unanswered by some participants, particularly in the case of medically compromised patients. The lower popularity of long-form oral health assessment instruments was compounded by the complexity and time needed for interpreting the results (Jones et al., 2004). Hence, it became necessary to develop shortened forms of OHRQoL measures.

Locker and Allen (2002) identified three ways for shortening OHRQoL measures. A statistical approach was the first method used in the shortening of the OHIP, where controlled regression
analysis was applied to produce the OHIP-14 (Slade, 1997b). The second utilized an expert-based approach. Using this method, experts in the field are consulted for their knowledge about a disease and its influence on quality of life. The content of the original instrument is narrowed based on expert judgment, which may also be aided by statistical information on individual items. The drawbacks of the expert-based approach are that it may lack objectivity and it may not be sufficiently representative (Coste et al., 1997). The third approach used an item-impact method (based on the items most frequently reported by patients and the severity of these impacts); an example of its use was the shortening of the OHIP by Allen and Locker (2002). Their rationale in using the impact-based method was that the regression-shortened OHIP-14 lacked adequate responsiveness because of the omission of items related to problems in chewing food. This meant that the later might not detect change in relation to treatment on edentulous patients. Locker and Allen (2002) found that the impact-shortened version of the OHIP was more likely to detect change in OHRQoL in a population over time. In contrast, the statistical-regression form was more likely to discriminate among different groups (Allen and Locker, 2002). Saub et al. (2008) compared two approaches used in producing the Malaysian shortened version of the OHIP; namely, the statistical and the item frequency methods. The authors concluded that each method produced different sets of items in the shortened versions, but both performed well when their psychometric properties were tested.

### 2.2.1.3 Choosing an OHRQoL measure

Several OHRQoL measures have been developed for different uses across a variety of conditions and populations. However, certain psychometric criteria should be met in deciding which measure to use. In 1996, the Scientific Advisory Committee (SAC) of the Medical Outcomes Trust developed a set of attributes\(^1\) and criteria\(^2\) for the assessment of HRQoL instruments in general (Lohr et al., 1996).

This set of instrument review criteria was revised in 2002 and broadened (Assessing Health Status and Quality-of-Life Instruments: Attributes and Review Criteria, 2002), mainly in order to be applicable to a wider range of HRQoL instruments.

---

1 Defined as “the categories of properties or characteristics that warrant separate, independent consideration in evaluation.”

2 Defined as “those conditions or facts within the attributes that are used as a standard by which something can be judged or considered.”
The OHIP meets all of the eight key attributes for reviewing health status and QoL instruments (that is, it has an underlying conceptual and measurement model; reliability; validity; responsiveness; interpretability; respondent and administrative burden; alternate forms; and cultural and language adaptations) set by SAC (John et al., 2004). The OHIP operationalizes a conceptual model, namely, Locker’s model of oral health. The broad concepts and dimensions that the OHIP is intended to measure have been described by the developers, as required by the SAC instrument review criteria (Slade and Spencer, 1994). Testing of the dimensionality of the OHIP, through the use of hierarchical cluster analysis, provided empirical support for the measure’s subscales (Brennan and Spencer, 2004).

Furthermore, the OHIP’s psychometric properties have been evaluated in a number of studies, and the responsiveness, reliability, and validity of the instrument have been established (Slade and Spencer, 1994; Slade, 1998; Allen et al., 1999). By shortening the OHIP to include only 14 items (in the OHIP-14), the respondent burden and administrative burdens were significantly reduced (Heydecke et al., 2004; McGrath and Rogers, 2010). Different modes of administration have been used to deliver the OHIP-14 in different studies (Steele et al., 2004). Information on the comparability of alternative modes has been provided by the developers of the OHIP (Slade et al., 1992).

2.2.1.4 The shortened version of the OHIP

The OHIP-14 is the most important and widely used shortened measure derived from the original version of 49 items (Slade, 1997b). Each of the seven aforementioned dimensions consists of a subset of 2 items. In spite of including 14 items only, the OHIP-14 has proven to have excellent validity and reliability when tested in a number of various dental settings (Locker et al., 2001a; Hegarty et al., 2002; McGrath et al., 2003; Robinson et al., 2003; Fernandes et al., 2006). The OHIP-14 has also demonstrated adequate sensitivity to change (Allen et al., 2001; Locker et al., 2004). The performance of the OHIP-14 has been compared to other OHRQoL instruments, including the Geriatric Oral Health Assessment Index (GOHAI), or what is now known as the General Health Assessment Index (Atchison and Dolan, 1990), and the Oral Impacts on Daily Performance (OIDP) instrument (Adulyanon et al., 1996). The GOHAI was specifically developed to assess the impact of oral conditions on the QoL of the elderly. Unlike the OHIP-14, the GOHAI is more focused on detecting functional limitation and pain than psychological and behavioural impacts, which are better detected by the OHIP-14 (Locker et al., 2001a). The OIDP, which was also based on Locker’s conceptual framework,
concentrates on the assessment of disability and handicap. It consists of 10 items demonstrating the daily physical, physiologic and social performances. It has been asserted that, in comparison with OHIP-14, the latter demonstrated superior face validity using the summary score and is accordingly more suitable for questionnaire-based research (Robinson et al., 2003).

Furthermore, Baker et al. (2006) compared the validity of the short form of the OHIP and the OIDP as measures of oral health-related quality of life in patients with xerostomia in the UK. They concluded that both the OHIP-14 and OIDP displayed good psychometric properties as OHRQoL measures in xerostomia. The correlation of OHIP-14 with participants’ symptoms of dry mouth was stronger that that with OIDP, and it may therefore be more suitable for this use.

The OHIP-14 has been translated to several languages and validated in the translated versions (van der Meulen, 2012), and has been judged to have an adequate cross-cultural adaptation (Allison et al., 1999).

2.2.1.5 Calculating OHIP-14 scores

Different scoring methods have been used for the OHIP-14. One method is to use a summary OHIP-14 score, in which responses for all 14 OHIP items (and the subscale scores) are summed to give an OHIP-14 score, with a theoretical range between 0 and 56 (Allen and Locker, 1997; Hegarty et al., 2002; McGrath et al., 2003). Another method uses a simple count score, calculated by counting the total number of problems reported (occasionally, often, or very often), to give a score range between 0 and 14 (Allen and Locker, 1997; Locker and Allen, 2002). The weighted and standardised scoring method gives each of the 14 questions a weight (Allen and Locker, 1997). Several authors have suggested that weighting the items does not improve the psychometric properties of the OHIP-14 (Allen and Locker, 1997; McGrath and Bedi, 2004a). Finally, the prevalence method is one in which the prevalence of the impacts that are experienced “very often” or “fairly often” are summed up at an item, a subscale, and a whole scale level (Thomson et al., 2006).

2.2.2 Relation between oral health status, general QoL, and OHRQoL

An emphasis has been placed on considering oral health as an integral part of the overall health of the individual. The notion that poor oral health is a further burden to general health has been explored in the literature (Locker et al., 2000). A review of the association between oral health
status and health-related QoL revealed that poor oral status was linked with poorer health-related QoL (Naito et al., 2006). Locker et al. (2000) found that older individuals who reported their oral health as poor had a lower morale, higher life stress, and were generally less satisfied with their lives when compared to those who reported their oral health more favourably.

From another perspective, while clinical measures of oral health are quite independent of oral health perceptions and OHRQoL, they are also correlated (Gift and Atchison, 1995). A body of evidence suggests that an impaired oral health status has an adverse effect on OHRQoL (Lawrence et al., 2008; Visscher et al., 2014). However, due to the nature of the conducted studies (cross-sectional), a direct causal relationship between the clinical oral status and OHRQoL cannot be established.

2.2.3 **Overview of the literature on OHRQoL**

By tradition, dentists have been trained to evaluate the clinical aspects of oral diseases and treat accordingly. The models of health and disease have conceptualised and continuously evolved since the World Health Organization broadened its definition of health (WHO, 1947). Self-reported oral health measures have emerged based on the multidimensional nature of health to capture the social and psychological aspects of oral conditions. The use of such measures in many population-based studies has revealed that OHRQoL is strongly affected by oral disorders. The OHIP-14 is the most widely used of OHRQoL measures. Used on different populations and in different study designs, it has shown good psychometric properties (John et al., 2004). According to the aforementioned health models, the characteristics of the individual play a role in the health perception process. More work is needed, however, to determine how self-reports on OHRQoL are affected by that role.
2.3 Xerostomia

2.3.1 Background

Both xerostomia and salivary gland hypofunction (SGH) are manifestations of dry mouth (Thomson, 2005). Xerostomia is best described as the subjective sensation of dry mouth (Locker, 1995b; Fox, 1996), whereas SGH is characterised by a substantial decrease in the unstimulated salivary flow rate (Sreebny, 1992). Xerostomia is a subjective feeling, thus a symptom of dry mouth. On the other hand, SGH is an objective finding (Navazesh et al., 1992), or a sign of the condition. SGH is diagnosed by clinical examination, in addition to objectively measuring stimulated and unstimulated salivary flow (Sreebny, 1988), whereas xerostomia can be assessed only by obtaining patient reports through questioning (Fox et al., 1987).

There appears to be confusion about the definition of xerostomia in the literature, because the terms xerostomia and SGH have been used interchangeably (Nederfors et al., 1997; Hopcraft and Tan, 2010). Although xerostomia and SGH are related, because xerostomia commonly occurs due to a reduction in the salivary flow (Sreebny and Schwartz, 1997; Nederfors, 2000), each of the two terms is a distinct entity. Xerostomia might be experienced by people who have normal salivary gland function (Fox et al., 1985; Sreebny and Valdini, 1987; Handelman et al., 1989). For example, in a longitudinal study investigating the relation between xerostomia and SGH among a population-based sample of South Australians, Thomson et al. (1999a) showed that only about 6% of the sample had both conditions concurrently, and that these comprised almost 15% of those who had either of the two aspects of dry mouth.

2.3.2 Xerostomia in relation to salivary gland hypofunction

2.3.2.1 Stimulated versus unstimulated salivary flow

One of the challenges relating to salivary investigations is the lack of consensus on the normal reference range when measuring salivary flow (Sreebny, 2000). Salivary flow is classified into resting or unstimulated saliva, and stimulated saliva. The unstimulated saliva, which constitutes the basal flow rate, is present in our mouths for 14 hours of the day. Stimulated saliva, on the other hand, is in the mouth for about 2 hours a day to mainly support the process of alimentation (Sreebny, 2000). An unstimulated (resting) whole salivary flow rate of < 0.1 ml/min is considered less than normal, whereas a flow of rate < 0.5 ml/min for the stimulated saliva is considered below the normal accepted range (Sreebny, 1992).
There is great variation in salivary flow rates in the same individual. The unstimulated salivary flow varies 10- to 100-fold across the lifespan of a healthy person (Baum, 1981; Ship et al., 1991). Furthermore, flow rates higher than the normal set values do not preclude SGH (Fox, 2008). Therefore, it has been recommended by some that individualised measurements are obtained after the age of 15 as a baseline record. A decrease by 50% of the established individualised measurement would then indicate SGH (Ship et al., 1991).

Although xerostomia reports cannot stand alone in the diagnosis of SGH, they are still valuable in identifying people at risk of SGH. Clinical assessment for signs of dry mouth and unstimulated salivary flow, as well as obtaining self-reports of xerostomia have been recommended (Nederfors, 2000). This would allow early identification of patients suffering hyposalivation, and therefore, allow timely prevention and intervention that may (in turn) improve the quality of life for these patients (Wiener et al., 2010).

2.3.2.2 The relation between xerostomia and salivary flow rate

One of the complexities in the relation between SGH and xerostomia lies in the definition of SGH, because it is complicated by the physiological variation in salivary flow during the day (Johansson et al., 2009), various collection protocols, a wide range of accepted values for normal salivary flow, and the use of different criteria to define hyposalivation (Navazesh et al., 1992). The diurnal variation in salivary flow may also have important implications on the results of salivary flow studies, depending on the time the samples are collected (Dawes, 1972). This difference in day- and night-time reported xerostomia was recently demonstrated by a 15-year longitudinal study on a Swedish population which showed that night-time xerostomia was more prevalent than day-time xerostomia (Johansson et al., 2009).

Previous studies have concluded that only 50-80% of patients complaining of subjective mouth dryness demonstrated clinically diminished salivary flow (Spielman et al., 1981; Sreebny et al., 1989). This phenomenon was mainly attributed to the presence of localized areas of dryness present in the oral mucosa, especially on the palate, which in turn may contribute to the subjective feeling of oral dryness despite there being adequate salivary flow (Dawes, 1987; Narhi, 1994; Wolff and Kleinberg, 1998). Conversely, a person may experience SGH but not xerostomia (Narhi, 1994; Wolff and Kleinberg, 1998; Thomson et al., 1999b; Dawes, 2004; Wiener et al., 2010; Ohara et al., 2013). For example, a recent Japanese study found that, of the participants that complained of xerostomia, 30% had normal salivary flow. Concurrently, 6.7% had hyposalivation but did not report xerostomia (Ohara et al., 2013). It is apparent from these
studies that subjective and objective salivary assessments are not necessarily in agreement. One possible explanation lies in the fact that a 40-50% reduction in salivary flow may be required before oral dryness is manifested (Dawes, 1987; Wolff and Kleinberg, 1999).

2.3.3 Prevalence of xerostomia

Xerostomia was reported by Locker (1995b) as the most common of 22 investigated oral symptoms and complaints. Nonetheless, in a systematic review addressing the prevalence of xerostomia, a controversy regarding this actual prevalence of xerostomia in the general population was highlighted, because a wide range of prevalence rates (0.9%-64.8%) have been reported (Orellana et al., 2006). The main reasons for such discrepancies were attributed to sample selection bias and different questionnaire formats. Some xerostomia prevalence measurements came from studies that used convenience clinical samples and may not be representative of the whole population (Thomson et al., 2005). Furthermore, most of these studies were conducted on Scandinavian population samples, and their findings may therefore not be generalisable to the rest of the world (Orellana et al., 2006).

Conventional wisdom suggests that xerostomia is more prevalent in the elderly population (Sreebny and Valdini, 1988; Nederfors et al., 1997; Bergdahl, 2000; Johansson et al., 2009). An important question arises to whether changes in self-reported xerostomia with aging were merely a consequence of medication use in the elderly population, or whether these observed differences were the result of the physiological aging process independent of diseases and/or medication use. A number of studies have attempted to answer this question. Early studies showed that the measured unstimulated whole saliva decreased in healthy, unmedicated elderly individuals (Ben-Aryeh et al., 1984; Lopez-Jornet and Bermejo-Fenoll, 1994; Percival et al., 1994; Yeh et al., 1998). However, the majority of these studies were cross-sectional in nature, and therefore could not establish a cause-effect relationship (Thomson, 2005). Scott et al. (1987) reported a decrease in the salivary gland acinar cells with ageing, while other authors demonstrated that salivary secretion remains age-stable in healthy unmedicated adults (Ship et al., 1995, Ghezzi et al., 2000). It is now widely accepted that the decrease in salivary flow in the elderly population is due to causes other than the “ageing” process, such as systemic diseases and medications, head and neck radiotherapy treatment, and dehydration (Ship et al., 2002).

The misconception that xerostomia affects only the elderly population has been challenged by many authors, who have shown that xerostomia can affect the young population (Sreebny and
Valdini, 1988; Bagesund et al., 2000; Bergdahl, 2000; Thomson et al., 2006). Nederfors et al. (1997) found the condition to affect 10% of unmedicated 30-year-old men and 20% of unmedicated 30-year-old women. Thomson et al. (2006) demonstrated that xerostomia can have a significant effect on the daily lives of 32-year-olds, 10% of whom had the condition. A similar xerostomia prevalence rate of 8.8% was found among 18-24 year old Japanese young adults (Mizutani et al., 2014). This later study, however, did not examine the effect of xerostomia on participants’ OHRQoL. When considering gender, most studies have found xerostomia to be more common among women (Sreebny and Valdini, 1988; Locker, 1993a; Narhi, 1994; Johansson et al., 2009), while others found that gender made no difference (Locker, 1995b; Thomson et al., 2006; van der Putten et al., 2011).

The ageing population is likely to increase in number (Lutz et al., 2008). This is due to the overall increase in the world population, advances in healthcare, and the decrease in fertility rates. Taking into consideration the effects of multiple pharmacotherapies and comorbidities from multiple chronic diseases in the elderly population, one could predict a steady rise in the prevalence of reported xerostomia and hyposalivation. Future research into xerostomia prevalence will show whether such predictions hold true.

2.3.4 Xerostomia and oral health

An adequate amount of saliva is paramount to oral health (Mandel, 1989). Saliva is a mechanical cleanser that helps in the digestion and preparation of food for mastication, a lubricant that aids in the swallowing process, and an important mediator in the process of taste perception. It also protects oral tissues against abrasions, lacerations and carcinogens; it protects the body against invasion of bacteria, viruses and fungi; and neutralizes the pH in the oral cavity. Furthermore, saliva plays an important role in maintaining the tooth integrity, by mediating the demineralisation-remineralisation process (Humphrey and Williamson, 2001; Dodds et al., 2005).

A low salivary flow may be associated with a high caries rate (Navazesh et al., 1992). However, early studies investigating the association between reduced salivary flow and caries had major flaws. Many of these studies used the DMF index as an indication of caries activity. This assumption is not accurate because the DMF index represents the cumulative caries and restorative experience, rather than being a measure of disease activity at a specific point in time (Dodds et al., 2005). Moreover, stimulated flow rate was considered the key contributor to salivary function in these reports (Sreebny, 1989b). It is currently accepted that unstimulated
saliva is the more important in terms of anti-caries activity. This is because the dentition is exposed to it most of the time. In addition, the unstimulated flow has more influence on oral sugar clearance than stimulated salivary flow (Dawes, 1983). Of interest, is the historical assumption that the intake of xerogenic drugs may cause greater caries experience. A study by Thomson et al. (2002) explored the relationship between medication intake as a risk factor for dry mouth and caries in a South Australian population-based cohort of older people, and found that medication per se was not a risk factor for coronal or root caries development.

Recent Japanese research investigated the relationship between reporting xerostomia and presence of gingivitis in young students (age 18-24). Higher plaque accumulation and bleeding on probing (BOP) scores were reported among those who were “xerostomics” (Mizutani et al., 2014). These findings may add another dimension to the influence of xerostomia on oral health and xerostomia may need to be considered when screening for gingivitis risk in young adults. However, this was a cross-sectional study and more research may be needed to look further into these findings.

2.3.5 Xerostomia and OHRQoL

The effect of xerostomia on OHRQoL has been described (Locker, 2003a; Ikebe et al., 2007; Enoki et al., 2014). Previous studies clearly indicated that both subjective and objective dry mouth conditions affect various aspects of OHRQoL for both elderly and young people (Thomson et al., 2006). Patients with objective dry mouth tended to report pain in the mouth more frequently (Gerdin et al., 2005), while those suffering xerostomia experienced a wide array of symptoms. The most commonly reported impacts were related to the inability to eat and enjoy all types of food, in addition to taking longer than others to finish meals (Locker, 1993a). Other reports cited having to keep the lips wet, getting out of bed to drink, difficulties in speech and swallowing, in addition to problems with taste perception as the most common impacts (Sreebny and Valdini, 1988; Spielman, 1990). Xerostomia may affect eating, chewing, and communication (Locker, 1993a), and may have significant sequelae in elders because it can cause avoidance of certain foods that may contribute to their malnutrition (Rhodus and Brown, 1990; Loesche et al., 1995). Xerostomic patients are also likely to suffer difficulties in denture retention (Niedermeier and Kramer, 1992). The effect of xerostomia on OHRQoL was investigated in a community-dwelling elderly Japanese sample over a five-year study period (Enoki et al., 2014). Participants whose xerostomia symptoms worsened also suffered
deterioration in their OHRQoL and the authors argued that xerostomia was a strong predictor of poorer follow-up OHRQoL.

Although the adverse effects of xerostomia on QoL are well documented in the literature (Sreebny and Valdini, 1987; Locker, 1993a; 2003a; Gerdin et al., 2005; Thomson et al., 2006), the relation between xerostomia, hyposalivation and QoL remains ambiguous. Most individuals affected by xerostomia may be already compromised by general health, psychological and economic problems. Therefore, it may not be clear to what extent xerostomia adversely affects their OHRQoL independent of other factors (Locker and Slade, 1993).

2.3.6 Aetiology of xerostomia

The use of xerogenic drugs is considered the most common cause of xerostomia (Guggenheimer and Moore, 2003; Scully, 2003, Villa et al., 2011). They are described as drugs that reduce salivary volume, or lower the patient’s threshold to the perception of the “dry mouth feeling” (Thomson, 2005). Sreebny and Schwartz (1986) identified more than 400 drugs capable of producing these symptoms. Authors have reported that the xerogenic effect may be more severe in those taking a greater number of prescribed medications (Thorselius et al., 1988; Handelman et al., 1989; Narhi et al., 1992; Wu and Ship, 1993; Sreebny and Schwartz, 1997; Schein et al., 1999). Dry mouth complaints seem to be a common finding in patients suffering from diabetes mellitus and hypertension and may be caused by these conditions, or medication use, or the combination of both (Dodds et al., 2000). Mouth breathing (Narhi, 1994) and psychological factors have also been implicated as potential causes of xerostomia (Fox, 1996). Furthermore, smoking and/or alcohol have been considered in relation with xerostomia. However, the evidence remains inconclusive, and this possible association warrants further investigation (Thomson, 2005).

2.3.7 Measuring xerostomia

To date, various methods have been developed to measure xerostomia. A single-item question has been the main method for its evaluation (Thomson, 2005). However, this method has serious limitations. One key problem is that a single-item question tends to categorise a patient as xerostomic or non-xerostomic according to an arbitrary cut-off point (Hopcraft and Tan, 2010) and can yield prevalence rates that vary within the same population according to the type of question used (Ikebe et al., 2007).
Fox et al. (1987) introduced 4 questions measuring xerostomia in an effort to gain a more comprehensive assessment of the condition. These questions were derived from a study on a convenience sample which included only people who had both SGH and xerostomia. Later, Narhi et al. (1999) introduced a 16-item scale for the evaluation of xerostomia complaints amongst the study participants, evaluating both oral and non-oral complaints related to the perception of dry mouth. Despite the expansion from a single-item question to multiple questions, a major source of weakness in both of these studies was that the responses were restricted to “yes” or “no”. This limited the ability to rank the severity of the respondents’ subjective complaints (Thomson, 2005).

Thomson et al. (1999b) developed the Xerostomia Inventory (XI), a multidimensional scale composed of 11 items relating to an individual’s xerostomia experience. Each question has five possible responses (“never”, scoring 1; “hardly ever”, 2; “occasionally”, 3; “fairly often”, 4; and “very often”, 5). The scores are summed to produce a continuous scale score with a possible range from 11 to 56. The inventory was developed to discriminate among the different levels of xerostomia severity (Thomson, 2005). The validity of the XI was tested in a study conducted over 6 months when patients receiving head and neck radiotherapy were compared to an elderly population (Thomson and Williams, 2000). Subsequently, it has been further tested to determine its suitability as an outcome measure, and its ability to detect changes in xerostomia symptoms over time (Thomson, 2007). Results from this research suggested that the XI has an acceptable validity and responsiveness.

The XI has been used in a number of studies (Johnstone et al., 2001; Bots et al., 2005). Furthermore, it has been translated into several languages (McMillan et al., 2006; da Mata et al., 2011; van der Putten et al., 2011) and its validity tested in these versions (da Mata et al., 2011).

A Dutch investigation that used the XI on 55 resident homes reduced the response options from 5 to 3 (“Never,” scoring 1; “Occasionally,” 2; and “Often,” 3), because the participants experienced difficulties in distinguishing among the 5 response options. This modified version was named the Summated Xerostomia Inventory-Dutch Version (SXI-D; van der Putten et al., 2011). The study found that the diagnostic suitability of the inventory may be improved if some items are omitted. The SXI was subsequently shortened to include only 5 items (my mouth feels dry when eating a meal; my mouth feels dry; I have difficulty in eating dry foods; I have difficulties swallowing certain foods; my lips feel dry) and omitted questions pertaining to dryness of the skin, nose and eyes (such as “my eyes feel dry”), or to behaviour (such as “I get up at night to drink”). This instrument was further tested on convenience samples from
Australia, The Netherlands, Japan and New Zealand (Thomson et al., 2011b). Findings indicated that the shortened version showed evidence of validity for testing xerostomia symptoms for clinical and epidemiological research purposes. Furthermore, by omitting some of the items, it enjoyed superior face validity over the original version. It would, however, be useful to test the shortened version on a representative population sample, which would allow generalisation of the findings. Recently, a Chinese version of the SXI has been validated on a patient sample in mainland China (He et al., 2013). The study used a sample of patient who suffered xerostomia because of drugs intake.

2.3.8 An overview of the literature on xerostomia

Xerostomia *per se* is not a life-threatening condition. Nevertheless, obtaining subjective reports of dry mouth remains important because of a probable association with underlying systemic disease (Sreebny, 2000). In the event that xerostomia is caused by SGH, its early identification is important for preventing the associated oral complications (Narhi et al., 1999).

Considering these factors collectively, while bearing in mind the likelihood of future increase in xerostomia prevalence, xerostomia investigations ought to be an integral part of oral health evaluation. However, Hawkins and Locker (2005) found that dentists assume that their patients will voluntarily provide information about their dry mouth complaints without being asked about the condition. Sreebny (2000) pointed out that few dentists are likely to inquire into patients about feelings of dry mouth, or measure salivary flow. Folke et al. (2009) suggested that more compassion is needed from clinicians treating this condition, and there should be better education on its recognition and management among healthcare professionals.

In summary, the possible effects of xerostomia on OHRQoL are not trivial; the condition causes physical, psychological, and social impairment for both affected young and old people (Thomson et al., 2006). There is a need for future xerostomia investigations that address the number of problems that have been identified with this type of research, such as issues with the measurement of xerostomia, the association between dry mouth and OHRQoL, and potential confounding variables to this association (Thomson, 2005).
2.4 Dental Anxiety

2.4.1 Background

One of the most common fears is in relation to dentists and dental treatment (Agras et al., 1969; Fiset et al., 1989). Levels of dental anxiety remain the same despite advancements in technology and better dental pain management. Dental fear, dental anxiety, and dental phobia, although closely related, are distinct entities (Poulton et al., 2001). Klingberg and Broberg (2007) noted the difference between these three types of reactions. While dental fear was considered to be more of a normal reaction to certain dental stimuli, dental anxiety was considered as “a state of apprehension that something dreadful is going to happen in relation to dental treatment, and it is coupled with a sense of losing control”; dental phobia was defined as “a severe type of dental anxiety and is characterised by marked and persistent anxiety in relation either to clearly discernible situations/objects (such as drilling, injections) or to the dental situation in general”. Armfield (2010a), on the other hand, argued that dental phobia (in contrast to dental fear and dental anxiety) requires psychological diagnostic criteria. The problem with using the three terms (dental fear, anxiety and phobia) interchangeably was noted by Armfield (2010a), as no distinction has been made between these different types of reactions in the majority of the published literature. The same can be said about the existing dental anxiety measures, where questions that measure anxiety are mixed with ones that measure fear stimuli (Schuurs and Hoogstraten, 1993).

Dental anxiety has long been recognised. In 1926, Wile suggested ways of dealing with dentally fearful child patients, but the origins of those fears were not provided in that publication. Richardson (1936) noted the presence of ‘fearful’ dental patients and distinguished the impact their fear had on dental treatment. Subsequently, in a large representative sample from the U.S.A., Friedson and Feldman (1958) found that, of the 51% of participants who did not attend the dentist regularly, 19% did so out of fear of dental treatment.

2.4.2 Dental anxiety: epidemiology

A wide variability (2.6% to 20.4%) in the prevalence of dental anxiety has been reported in the literature (Locker et al., 1996a). This may, in part, be explained by the use of different dental anxiety measures, the different populations being studied, and the use of different cut-off points to differentiate anxious patients from their non-anxious counterparts (Locker et al., 1996a). Furthermore, some were conducted on preselected population samples, making them
susceptible to selection bias (Vassend, 1993). Some studies measured “dental fear”, while others measured “dental anxiety”. This may have further contributed to the variation in the prevalence rates (Locker et al., 2001b). Armfield (2011) used three different scales to measure dental fear on an Australian population sample; a single item measure, Corah’s Dental Anxiety Scale (DAS), and the newly introduced Index of Dental Anxiety and fear (IDAF4C+; Armfield, 2010b). The study found that the prevalence estimates varied depending on the scale and the cut-off points used. When the mid-point of the scale (‘moderately afraid or distressed’) was excluded in the single item measure, the prevalence estimate declined from 18.8% to 7.8% (Armfield, 2011).

Many studies have investigated dental anxiety in relation to age and gender. Most found dental anxiety to be more common in women than in men (Fiset et al., 1989; Neverlien, 1990; Hakeberg et al., 1992; Locker et al., 1996a), with some showing that the prevalence is twice as high for women as for men (Thomson et al., 1996). A few studies have reported insignificant differences or equal levels of anxiety between the two genders (Schwarz, 1990; Hakeberg et al., 1992). It can be argued that women tend to express their anxiety, thereby explaining the frequently higher prevalence (Schwarz, 1990). The published prevalence rates of dental anxiety in relation to different age groups have yielded conflicting findings. Young adult groups seem to have the least dental anxiety of all adult age groups (Milgrom et al., 1988; Hakeberg et al., 1992). However, when demographic factors other than age and gender have been studied, the findings have been conflicting. Several authors found a positive relation between dental anxiety and factors such as education, income, and occupation (Fiset et al., 1989; Moore et al., 1993; Erten et al., 2006). In contrast, others demonstrated non-significant associations with these characteristics (Neverlien, 1990; Hakeberg et al., 1992; Mehrstedt et al., 2004).

2.4.3 Consequences of dental anxiety

Dental anxiety poses a major public health concern because of its negative impacts on oral health and general well-being (Hakeberg et al., 1993; Mehrstedt et al., 2004). The consequences of dental anxiety are well documented. It is a major impediment to dental attendance (Nuttall et al., 2001). Dentally anxious individuals are more likely to be irregular attenders (Schuurs et al., 1984; Woolgrove and Cumberbatch, 1986; Skaret et al., 2000; Sohn and Ismail, 2005), and are more likely to avoid dental treatment altogether for years because of their anxiety (Skaret et al., 1999). Moreover, dental anxiety accounts for time away from school or work on sick
leave (Hakeberg and Berggren, 1993). The dentally-anxious group of patients are also believed to be a major cause of stress to the dental practitioner (Cooper et al., 1987).

Anxiety surrounding the dental environment has been connected to poorer oral health due to avoidance or delay in seeking dental treatment. These patients have a greater number of missing teeth, more decayed surfaces, and fewer restored teeth than non-dentally-anxious patients (Bedi et al., 1992; Thomson et al., 2000). The consequences of dental anxiety may go further (than affecting oral health) to influence general health, in that avoiding treatment may result in dental diseases which have been implicated in severe health complications such as facial osteomyelitis, pneumonia, urinary tract infection, fever, and septicaemia (Hollister and Weintraub, 1993).

2.4.4 Dental anxiety and OHRQoL

Although studies on the relationship between dental anxiety and OHRQoL are still scarce, there is an indication that dental anxiety has a profound influence on QoL in a way that it affects the psychological, functional, and social dimensions of a person’s daily life (Reisine et al., 1989; Mehrstedt et al., 2004; Vermaire et al., 2008). Dental anxiety has a negative impact on its sufferers, in that they perceive their oral health to be poorer than their non-dentally anxious counterparts (McGrath and Bedi, 2004b). Gisler et al. (2012) found, in a study of Swiss patients attending university clinics, that patients who were dentally-anxious are 3.5 times more likely to suffer a poor OHRQoL. They pointed out that the reason for the association between dental anxiety and OHRQoL might lie in the fact that dental anxiety leads to neglect of oral conditions and oral diseases remaining untreated.

The degree of OHRQoL impairment has been related to the severity of the dental anxiety (Mehrstedt et al., 2007). Locker (2003b) described the magnitude of the psychosocial impacts caused by dental anxiety. The majority of the dentally anxious group (52%) in his study described feeling foolish about being dentally fearful, while 46% reported worrying about the condition of their dentition. Feelings of being disturbed when going to the dentist were expressed by 37% of the participants, whereas 35% reported concealing their dental anxiety from others. Finally, dental treatment after years of avoidance significantly improved the QoL for patients who avoided the dental surgery for a long number of years (Vermaire et al., 2008). Hakeberg and Berggren (1993), reported that fewer days were taken off work among people whose dental anxiety had been treated.
2.4.5 Dental anxiety Aetiology

Given the high prevalence of dental anxiety, repercussions for oral health, and patient management, it is important to better understand the origins of dental fear and the mechanisms involved in its development. Moreover, better knowledge of the factors underpinning dental anxiety origins would allow for improved prevention and intervention strategies for dentally anxious patients (Poulton et al., 2001). This would subsequently help improve patients’ oral health, general well-being, and quality of life (Locker, 2003b).

A sensible approach to understanding how dental fear develops would be to answer the following questions: what makes some individuals more susceptible to dental anxiety; how do dental anxiety and phobia develop; and why do some patients with past aversive dental experiences develop dental phobia, while others do not? Researchers have tried answering these questions. As a result, many theories have been introduced. Some of these have stemmed from psychological models. The main hypotheses have highlighted the roles of conditioning, heightened pain sensitivity, and personality characteristics (emphasizing neuroticism) as a causal factors in dental anxiety development (Vassend et al., 2011).

Understanding the nature of dental fear (the nature of stimuli that evoke the patient’s dental anxiety in the dental setting) is considered important, because it allows investigation of effective strategies for dealing with a particular fear (Armfield et al., 2006). The part of dental treatment seen as threatening to the patient has been investigated. Fear of experiencing pain has been found to be the predominant type of fear (Bare and Dundes, 2008), while fear of injections (Smith et al., 1987) or loss of control in the dental setting were highlighted by others (Moore et al., 1991). Bare and Dundes (2008) suggested that knowing what part of dental treatment the patient is tense about helps clinicians find ways to alleviate fear surrounding that treatment.

2.4.5.1 Direct conditioning

One of the oldest explanations for development of dental fear comes from the direct conditioning model. This proposes that fears develop in reaction to negative or traumatic experiences. Direct conditioning is traditionally demonstrated using the classical “little Albert”
experiment by Watson and Rayner (1920), in which conditioned stimuli were used on an infant to elicit fear responses.\(^3\)

The literature is replete with studies that provide evidence for the role of aversive dental experiences in the development of dental anxiety (Bernstein et al., 1979; Davey, 1989; Liddell, 1990; Milgrom et al., 1995). Lautch (1971) attributed children’s susceptibility to acquire fears to the facilitatory developmental stage; children are likely to develop fears when encountering a new situation. Accordingly, dentists’ attitudes and behaviours were sometimes blamed for this type of early-onset dental fear (Berggren and Meynert, 1984; Moore et al., 1993). Ten Berge et al. (2002) suggested that traumatic past dental experiences did not play a significant role in the development of dental fear, and that it was subjective conditioning experiences, mainly the dentist’s attitudes that were strongly implicated in fear development. An “empathetic” and “caring” dentist is seen was less likely to leave a negative influence than a “cold” and “uncaring” dentist when pain was involved in a dental procedure (Bernstein et al., 1979; Milgrom et al., 1992).

Locker (1996b) suggested that the nature of the negative dental experience was more important than the age at which they occurred. He distinguished between two types of aversive experiences: direct negative experiences and response negative experiences. The former included experiences that evolve from dental treatment itself such as pain, fear, or embarrassment; or from the relation between the patient and the dentist, whereas the latter included a patient’s emotional responses to dental treatment, such as fainting or having panic attacks. Many investigators have found that direct negative experiences (in particular) were strongly associated with dental anxiety development (Davey, 1989; de Jongh et al., 1995; Locker et al., 1996b). Different feelings, in particular fright, pain, and embarrassment have been implicated in this process (Locker et al., 1996b).

In contrast, several studies have shown that aversive dental experiences do not necessarily lead to dental phobia or dental anxiety. Davey (1989) based his explanation for this phenomenon on the psychological model of latent inhibition. According to this theory, when a positive association with dental treatment is established after a number of painless dental visits, an individual is less likely to develop dental phobia and anxiety if later subjected to a traumatic dental stimulus. Some evidence for the role of latent inhibition in preventing dental anxiety has

---

\(^3\) The study tested the conditioning of a loud noise presented simultaneously with a rat to Albert (who did not fear rats prior to the experiment), and reported after a few pairings of the rat and noise that Albert reacted with crying to the presence of the rat in absence of the noise.
been provided by a number of studies (Davey, 1989; de Jongh et al., 1995; Ten Berge et al., 2002).

Although the classical conditioning model had some role in clarifying the origins of dental fear, it fails to explain many of the characteristics associated with dental fear and/or anxiety. The main shortcoming of this model was that many people with phobias were unable to recall a traumatic event related to their fear (Rachman, 1977). This led to the introduction of other theories which suggested the involvement of indirect mechanisms in dental fear development.

### 2.4.5.2 Modelling and vicarious learning

In response to the limitations of the direct conditioning theory, Rachman (1977) modified this model by expanding it. He proposed that, in addition to direct conditioning, fears and phobias may also be acquired via indirect routes, without any previous exposure to traumatic events. The two additional pathways proposed by Rachman for fear acquisition were vicarious (observational) learning, and exposure to negative or threatening information. This may, in part, explain how fears develop in those who have not been exposed to an aversive dental experience.

The three routes suggested by Rachman have been investigated. Some authors postulated that children’s dental fear is rooted in the attitudes of their parents. Shoben and Borland (1954) suggested that dental fears originate within one’s home. These authors further emphasised that negative family influences and experiences were the most significant factor in determining the individual’s unfavourable reaction towards future dental treatment. Milgrom et al. (1995) suggested that children are twice as likely to develop dental anxiety when their guardians exhibited moderate to high dental fear as are children who have guardians with low dental fear. This view, however, was not shared by Ten Berge et al. (2003), who found no relation between children’s dental fear and that of their parents.

### 2.4.5.3 Conditioning models: drawbacks in relation to explaining dental anxiety origins

Many investigators have argued against the conditioning theory being the main explanation for dental anxiety acquisition (Vassend et al., 2011). Dental anxiety has been classically viewed as a fear that originates in childhood. This finding, however, has failed to explain all the complex observations associated with what is a multidimensional phenomenon. Firstly, many receive dental treatment, yet few acquire dental anxiety (Ten Berge et al., 2002). Secondly, some dentally fearful patients do not recall previous aversive dental experiences (De Jongh et al.,
Finally, study designs relating dental anxiety to past dental experiences were mostly conducted on highly selected samples and based on retrospective reports from participants. Retrospective studies are often associated with limitations in relation to the recall of past experiences, and reanalysing the data (Locker et al., 1999; Thomson, 2000b). A few longitudinal studies have been designed to evaluate the role of conditioning in the construction of dental anxiety (Murray et al., 1989; Locker and Liddell, 1995; Thomson et al., 1997; Thomson et al., 2000). Some surprisingly found that, in about 15% of dentally anxious people, their dental anxiety was acquired in adulthood (Berggren and Meynert, 1984; Milgrom et al., 1988). This led to investigations into the differences between childhood and adult-onset anxiety. Of importance are the distinct personal and psychological characteristics of the adult-onset group of dentally anxious patients (Locker et al., 1999). This is further discussed in section 4.4.5.5.

2.4.5.4 Oral health status as a predictor of dental anxiety

Milgrom et al. (1995) described oral health status as an important predictor of dental anxiety. They ascribed this to the need for more dental visits and more invasive treatment in patients who suffer poor oral health as a result of their anxiety. Poulton et al. (1997) noted that dental fear development could be influenced by oral habits in late teens and early adulthood, and that it was important to observe the oral health status and care in these developmental periods to prevent future dental anxiety. Berggren and Meynert (1984) described the vicious cycle of dental anxiety (Figure 3), where the avoidance of dental treatment led to poorer oral health. This (in turn) was likely to lead to feelings of embarrassment and inferiority as a consequence of bad appearance and thereby increase the likelihood of an escalation in the level of anxiety. The feelings of shame and embarrassment further contribute by reinforcing the dental avoidance behaviour. The dental visiting pattern as a result become emergency-related rather than preventive, aggravating both poor oral health and dental fear, as clinic visits are essentially only for pain relief. According to this model, both poor oral health status and dental fear fed the vicious cycle. Data from more than one study has provided support for the vicious cycle model (Thomson, 1996; Locker, 2003b).
In addition to Rachman’s pathways (Rachman, 1977), research has provided support for other aetiologies involved in dental anxiety acquisition. It has been suggested that some psychological variables may be linked; such as general anxiety disorder and neuroticism (Moore and Brødsgaard, 1995). The notion that dental anxiety may be part of a more generalised psychological disorder has been promulgated by many researchers. A Seattle population study by Fiset et al. (1989) showed that individuals with one or more common fears were likely to report dental fear as well. Weiner and Sheehan (1990) suggested that dentally-anxious individuals fall under two categories. The first is an endogenous type, in which dental anxiety is part of a general disorder involving multiple phobias and psychiatric disorders. In other words, dental anxiety may be part of a constitutional vulnerability that makes some individuals susceptible to anxiety disorders (Krueger et al., 1996). The second, an exogenous type, in which dental anxiety may have emerged as a result of encounter with past negative dental experiences. Roy-Byrne (1994) found that dental phobia was part of a general anxiety disorder in 30% of dentally-phobic patients. In a study of a young adult New Zealand population, Locker et al. (2001b) found that individuals with high levels of dental anxiety were more likely to have been diagnosed with a psychological disorder than non-anxious and moderately anxious individuals. Furthermore, dental anxiety that was part of a psychological disorder was believed to be maintained over time (Locker et al., 2001b). One of the few longitudinal studies on the origins of dental anxiety in a young adult New Zealand population found that aversive conditioning played a role in the development of dental anxiety in adolescence (Thomson et al., 1997). In contrast, the study found that conditioning did not seem to contribute to the adult-onset type of dental anxiety. Furthermore, the findings suggested that particular temperamental or psychological traits might instead contribute to the later type
(Thomson, 2000). Similarly, in a longitudinal study by Locker (2003b) of a Canadian population sample, 73% of the dentally fearful or anxious patient group had one or more severe fears, while 25% had five or more severe fears. These were classified into two groups; high and low general fear groups. The low fear group reported to have fear related to dental treatment, while the high fear had a more complicated general psychological profile involving generalised anxiety and a lower self-esteem. Personality involvement in dental fear development was earlier suggested by Venham et al. (1979). Schurrs et al. (1988) found that dentally-anxious patients possessed a number of different personality traits compared to the control group. The dentally-anxious group were generally more neurotic, unable to take action, feared loss of control, and possessed lower self-esteem.

Locker et al. (1999) proposed that the types of anxiety may differ according to the age of onset. They suggested that early-onset dental anxiety was more likely to be related to the exogenous type, while the late onset anxiety was more likely to be associated with the endogenous type. Bearing in mind that these are not clear-cut types, and there is an overlap between the two in that both types demonstrate a degree of exogenous features. Moreover, the authors proposed that negative family influences were only predictive of childhood-onset dental fear. This was in accordance with the findings of Ost (1987) and Milgrom et al. (1995), who suggested that conditioning and modelling, were significant factors in the development of early onset fear.

Findings from the Dunedin Multidisciplinary Health and Development Study (Thomson et al., 2009) suggested the presence of a distinctive pattern of dental anxiety trajectories in the study members. The six discrete dental anxiety groups observed were: stable non-anxious low, stable non-anxious medium, recovery, adult-onset anxious, stable anxious, and adolescent-onset anxious. The study found that conditioning experiences were particularly important in the aetiology of the stable non-anxious low and medium groups and suggested that early aversive dental experiences can have a long-lasting effect on susceptible individuals, by virtue of their personality characteristics. The study also observed that external influences (such as caries experience and tooth loss) were linked to some of the trajectories (more than 90% of the cohort), while others were linked to the influence of personality characteristics (such as scoring high on the stress reaction). A combination of both influences was linked to the stable anxious group. Weiner and Sheehan’s classification of exogenous and endogenous aetiologies of dental anxiety received some support in these trajectories.
2.4.5.6 The cognitive vulnerability model

The cognitive vulnerability model has been recently examined to assess its role as a factor involved in dental anxiety (Armfield, 2008, 2010c; Carillo-Diaz, 2012). This model proposes that dentally anxious patients judge the dental stimulus as being uncontrollable, unpredictable, potentially dangerous or harmful, and disgusting. The cognitive model aims to provide an explanation for some of the encountered differences between dentally anxious and non-anxious patients. It may also provide an explanation for development of dental fear in patients without past aversive experiences and vice versa. According to the model, dentally anxious individuals anticipate the likelihood of dental events being highly aversive. They also experience negative thoughts about themselves, the dentist, and dental visits. This has been termed by Wardle (1984) as “dental pessimism”. This does not rule out the role that aversive experiences may have in dental fear. However, it proposes that, in dentally fearful patients, it is the perceptions of the stimulus that may elicit dental anxiety rather than the experience itself that is encountered. The stimulus is therefore perceived and processed within the individual’s environment and personality predispositions.

2.4.6 Measures of dental anxiety

A plethora of scales have been used in the literature to identify dentally anxious people and measure the level of their dental anxiety. Table 1 provides a list of the most widely used dental anxiety measures in the adult population.
### Table 2.1. Most commonly used dental anxiety measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Author and year</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corah’s Dental Anxiety Scale</td>
<td>Corah (1969)</td>
<td>4</td>
</tr>
<tr>
<td>Modified Dental Anxiety Scale</td>
<td>Humphris et al. (1995)</td>
<td>5</td>
</tr>
<tr>
<td>Kleinknecht’s Dental Fear Survey</td>
<td>Kleinknecht (1973)</td>
<td>27</td>
</tr>
<tr>
<td>Dental Anxiety Question</td>
<td>Nevrlien (1990)</td>
<td>1</td>
</tr>
<tr>
<td>Dental Anxiety Inventory</td>
<td>Stouthard (1989)</td>
<td>36</td>
</tr>
<tr>
<td>Dental Anxiety Inventory Short Version</td>
<td>Stouthard (1994)</td>
<td>9</td>
</tr>
<tr>
<td>The Index of Dental Anxiety and Fear (the core module)</td>
<td>Armfield (2010b)</td>
<td>8</td>
</tr>
</tbody>
</table>

#### 2.4.6.1 Corah’s Dental Anxiety Scale (DAS)

Introduced by Corah in 1969, this scale has been the most widely used dental anxiety measure. The respondents are asked to complete it by choosing one of five response options to each of the four questions indicating the severity of their dental anxiety. The scale yields a possible score of 4 to 20, with scores greater than 13 (in some studies greater than 15) being indicative of dental anxiety (Corah et al., 1978).

There is no doubt that the DAS has been the most extensively used dental anxiety scale. However, it has been criticised for having several flaws and the conceptual basis behind its development was never explained (Schuurs and Hoogstraten, 1993). It is unable to distinguish between different levels of anxiety, and is likely to identify extremes of low and high anxiety, but not mild or moderate levels. It is also unlikely to distinguish between dental fear and dental phobia (Armfield, 2010a). In addition, the response format of the scale has been criticised for having some inadequacies (Humphris et al., 1995). One is the lack of consistency in answers across the four questions, which makes them difficult to compare. The other is that the answers may not reflect the severity of the anxiety in an orderly fashion (Humphris et al., 1995).

#### 2.4.6.2 Modified Dental Anxiety Scale (MDAS)

The MDAS (Humphris et al., 1995) was introduced as a modified version of the DAS in recognition of the numerous problems associated with the later. A fifth item pertaining to the
fear of intra-oral injections was added to the scale. In addition, the possible response options were altered in the new measure to give a clear order for anxiety, and identical response options for all questions.

2.4.6.3 Single-item dental anxiety measures

A number of single-item scales have been introduced to identify dentally anxious patients. One such measure is the Dental Anxiety Question (DAQ), a single-item scale that uses the question “Are you afraid of the dentist?” (Neverlien, 1990). Others include the single-item indicators used by Milgrom et al. (1988), and Gatchel et al. (1989).

2.4.6.4 Kleinknecht’s Dental Fear Survey (DFS)

This is the second most commonly used measure of dental anxiety. The DFS (Kleinknecht, 1973) was developed to give information on the reactions to dental stimuli that may elicit fear reactions or avoidance behaviour, rather than producing a single scale score. Armfield (2010a) argued that using the DFS was not intended to measure dental anxiety. It therefore proposed that it might be useful in giving information on patients’ reactions to specific dental stimuli, but should not be used as a dental fear measure (Armfield, 2010a).

2.4.6.5 Stouthard’s Dental Anxiety Inventory (DAxI)

Developed in the late 1980s by Stouthard in an attempt to overcome the methodological shortcomings of the DAS and DFS, the DAxI was based on the theoretical construct of anxiety disposition (Stouthard, 1989), and aimed to measure situation-specific trait anxiety. It was originally abbreviated as “DAI”, but this was later modified to DAxI to prevent confusion with the Dental Aesthetic Index (Cons et al., 1986). Each of the 36 items of the DAxI measures the reaction to a specific dental situation. Stouthard based the measure on a three-faceted design. The facet elements are three different kinds of situations that may trigger dental anxiety (the actual dental treatment, the professional interaction between dentist, and patient communication about treatment), preliminary aspects of the dental treatment at four different times (at home, on the way to the dentist, in the dentist's waiting room, in the dental chair) and three resultant reactions (emotional feelings, physical reactions and cognitive reactions; Stouthard, 1995).
Thus, the time dimension is being taken into consideration when each reaction is assessed (how long before the appointment that reaction appears).

Despite the efforts to overcome the shortcomings of the previous dental fear scales by basing it on a solid theoretical construct, the DAxI is a lengthy questionnaire, and this restricts its use as a dental anxiety measure. A shorter version of the questionnaire was introduced by reducing the number of items to nine (Stouthard, 1994). Armfield (2010a) however, believed that this has resulted in a theoretically compromised version (Armfield, 2010a).

Although the aforementioned measures can differentiate the dentally anxious from the non-anxious, Armfield (2010a) has suggested that a problem common to all of these scales is a deficiency in identifying individuals with dental phobia. This problem potentially arose from the use of arbitrary cut-off points, without the use of a solid scientific basis to distinguish dental anxiety from phobia. This led Armfield to develop of a dental fear scale, that he named the Index of Dental Anxiety and Fear (IDAF-4C+; Armfield, 2010b).

2.4.6.6 The Index of Dental Anxiety and Fear (IDAF-4C+)

The IDAF-4C+ was introduced to overcome the theoretical and practical limitations of the previously developed dental fear measures (Armfield, 2010b). The IADF-4C+ comprises three “modules” that measure respectively; dental anxiety and fear, dental phobia, and feared dental stimuli. Armfield envisioned that this approach would allow clinicians to use the module that is of interest, taking into account the different origins of dental fear and/or dental anxiety. The abbreviation IDAF-4C+ signified the modules comprising the index. The (4C) specifies the four dental anxiety and fear components, namely the cognitive, emotional, behavioural, physiological components (Stouthard et al., 1993), and the added modules are indicated by the “+”.

In developing his new scale, Armfield aimed for strong theoretical underpinnings behind it, and for a measure that was practical to use for the dental clinician, as well as in the epidemiological field. The dental fear and anxiety module (IDAF-4C) was the core module. This module is considered central to determining the person’s level of dental fear. Initially, the core module comprised 29 items measuring the above mentioned four fear and anxiety components. An expert group reduced these to 16 items, with four items representing each of the four anxiety and fear components. Based on subsequent statistical analysis, these were further reduced to
eight items, with two items representing each of the four anxiety and fear components (Armfield, 2010b).

The stimulus module, contains 10 items that are beneficial in gathering more information about the person’s anxiety experience in relation to fear of specific dental stimuli. The phobia module is useful in the event that the clinician or researcher wishes to make a primary diagnosis of a complex fear problem that involves his/her psychological backgrounds. Comprised of five items, the phobia module was based on the criteria of the American Psychiatric Association’s *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) for specific phobia (American Psychiatric Association, 1994). A total score of three or more on the phobia module was considered to meet the diagnostic criterion for marked fear as defined by the DSM-IV.

The IDAF-4C+ has been adapted into many languages (Carillo Diaz et al., 2012; Quenneville, 2013; Tönnies et al., 2013). Reliability and validity data for Spanish and German versions of the index were published recently (Carillo Diaz et al., 2012; Tönnies et al., 2013). However, it is difficult to generalise the results as the aforementioned studies were conducted on convenience samples. Consequently, there is a need to conduct more studies on representative population samples.

In summary, the existing dental anxiety measures all suffer from conceptual and practical flaws. An exception to this might be the most recently introduced IDAF-C+ (Armfield, 2010b). In view of the novelty of the scale, whether this holds true is yet to be determined.

### 2.4.7 Dental anxiety treatment

Because dental anxiety patients are not homogenous, dentists need to be aware of the different diagnostic categories of dentally fearful/dentally anxious/or dentally phobic patients. Smith *et al.* (1987) suggested that symptoms of moderate dental fear can be relieved by a well-trained and interested dentist. Moore (1991) pointed out that the above diagnostic categories entail different approaches to treatment. Desensitisation was considered to be an effective treatment strategy for conditioned dental fear, while psychotherapy was the suitable approach when the fear was part of a more complex phobia. The authors suggested that dentists may be the first health professionals to encounter the latter category of patients, and therefore should be able to identify them and refer them to a psychologist for treatment.
2.4.8 An overview of the literature on dental anxiety

There is no doubt that there is much more to be known about dental anxiety. It poses a persistent, yet not fully understood problem. Part of this is due to the fact that dental fear and anxiety are of a multifaceted nature. Furthermore, the aetiologies behind these conditions are complex and may not be fully comprehendable. Although the earlier explanations have been primarily based on the conditioning model as the sole aetiology involved in the acquisition of dental fear and anxiety, later evidence suggests that other factors may also play an important role. The findings of these studies suggest that conditioning experiences and psychological (personal) characteristics are both important in the construction of dental anxiety (Thomson et al., 2009). The role played by psychological characteristics in the construction of fears seem to be very complex, warranting more research to better understand the roots of dental anxiety and the factors involved in its development.

2.5 Negative affectivity

2.5.1 Introduction

The last three decades have witnessed a revival of interest in personality research (Krueger et al., 2000). This revival was the result of the realisation that personality traits are not only relatively stable (in a rank-order sense) over the life course (Roberts and DelVecchio, 2000), but are also dynamic (Caspi et al., 2005) in a way that can be intervened with to alter behaviour (Conrod et al., 2006). Epidemiological personology is one stream of personality research that uses population-based studies to look into the postulated effect of personality on social outcomes. Interest in this strand of research has been recently used to predict and understand health-related behaviours among other common problem behaviours (Krueger et al., 2000).

One of the areas that personality research has extensively investigated is the nature of self-reported mood. This has shown positive and negative affect to be important dimensions of the subjective mood experience (Bieser, 1974; Moriwaki, 1974; Warr, 1978; Costa and McCrae, 1980; Zevon and Tellegen, 1982; Watson and Tellegen, 1985; Watson, 1988).

Negative affect is one dimension of personality that describes an individual’s susceptibility to experience aversive mood states (Watson and Clark, 1984). In contrast, positive affect is the susceptibility for an individual to have pleasurable engagement with the surroundings. Tellegen (1982) has coined the terms negative affectivity (NA), and positive affectivity (PA) to describe
these mood states. Watson et al. (1988a) suggested that NA can be measured as a state (transient fluctuations in mood), or as a trait (stable individual differences in a general affective tone). In earlier reports of the literature, the NA trait was used synonymously with neuroticism (Watson and Pennebaker, 1989). Watson and Clark (1984) ultimately preferred the term NA over neuroticism, because they considered neuroticism to be a multifaceted dimension, in contrast to NA, which they described as having a unitary nature. NA incorporates a range of aversive mood states, such as anger, disgust, guilt, fearfulness, and depression. On the other hand, PA reflects a person’s level of energy, excitement, and enthusiasm (Watson and Pennebaker, 1989). People with high NA are likely to experience extreme negative mood states that include worry, tension, and nervousness; they are more likely to be distressed and unsatisfied with any given situation. High-NA individuals are also more likely to amplify negative experiences, view the negative side of the world, others, and themselves. Low-NA individuals, on the other hand, tend to be content, confident, and self-satisfied (Watson and Clark, 1984). Although NA and PA may seem to be opposites, they are (in fact) two distinct and largely independent dimensions of personality (Diener et al., 1984).

Watson and Clark (1988a) introduced the PANAS (Positive and Negative Affect Schedule), which they developed with the intention of overcoming the existing reliability and validity problems with the previous mood scales. The PANAS scale includes 10 items measuring positive affectivity (PA; interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, and active) and 10 items measuring negative affectivity (NA; distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, and afraid).

The PANAS has been the most widely used affect scale (Wright and Cropanzano, 1998). It has been used to study the effect of the mood, represented by NA and PA, on various human behaviour issues. These have included perceived stress and health-related complaints (Kaptein et al., 2005), job satisfaction (Wright and Cropanzano, 1998), cigarette smoking (Wertz and Sayette, 2001).

### 2.5.2 The personality-health link, and its relation to oral health

The assumption that one’s physical health is affected by psychological characteristics is embodied in the psychosomatic model (Costa and McCrae, 1987). Although the association between psychological factors and organic disease has been extensively studied in the medical literature, the nature of this relationship is controversial (Watson and Pennebaker, 1989). The opposite holds true for the effect of the psychological state on the self-reported or subjective
health, as the evidence is more conclusive (Costa and McCrae, 1985). Watson and Pennebaker (1989) found that NA trait is strongly associated with subjective health complaints, but not with the objective long-term health status. Personality factors, particularly NA were found to be significantly associated with the perception of poor health (Goodwin and Engstrom, 2002). Data from several studies have shown that individuals scoring high on a NA scale were more likely to self-report general health complaints (Blazer and Houpt, 1979; Costa and McCrae, 1980; Costa and McCrae, 1985; Clark and Watson, 1988; Watson, 1988; Watson and Pennebaker, 1989). Many authors have argued for explanatory theories on the cause of greater health complaints in high-NA individuals. One such theory proposes that, because high-NA individuals are introverts (internally or self-focused), they are more likely to attend to their body stimuli or pain sensations (Watson, 1988). Given their high anxiety and negative recycling of thoughts, they are also more likely to interpret ambiguous or painful stimuli in a threatening way (Watson and Clark, 1984). In comparison to the extensive body of literature published on the relation between personality and general medical complaints, the effect of personality on peoples’ perceptions of their oral health has only been recently investigated. It is important to understand the nature of this influence for several reasons that are discussed below.

Self-reported measures are increasingly being used as a result of the recognition that health is a subjective state (Locker, 1997). The respondent’s answers to self-report scale items depends on the perception of his or her own health status. Therefore, because these reports are entirely subjective and depend on the person’s own interpretation of their health, certain personality traits are likely to influence these self-rated reports (Thomson et al., 2011a). OHRQoL measures for example are increasingly being used in population-based studies to assess healthcare needs and interventions, and outcomes of care (Fitzpatrick et al., 1992). To get an accurate representation of people’s reports on their OHRQoL, the factors that influence these assessments must be considered (Kressin et al., 2000). People with high NA may inflate oral-health-related complaints through obtaining worse scores on quality of life measures (Kressin et al., 2001). Kressin et al. (2001) investigated the effect of NA on self-ratings of oral health. The study found that high NA individuals consistently reported a poorer OHRQoL. It is noteworthy, however, that the study sample comprised older veterans, and may not therefore be generalisable to women or younger age groups. A longstanding New Zealand cohort study of young adults found that particular personality characteristics confounded the association between OHRQoL and xerostomia (Thomson et al., 2006). A study on the same sample investigated the influence of personality in relation to OHRQoL, and found a consistent association between NA and reported poorer oral health (Thomson et al., 2011a). Ohara et al. (2013) found that reporting xerostomia symptoms was associated with psychological factors.
McGrath and Bedi (2002b) argued that dental anxiety and poorer OHRQoL coexisted in their study sample thus reflecting the psychological characteristics of the participants and their negative attitude. These aforementioned studies have one thing in common; they establish the presence of an association between personality and self-reported oral health.

Personality also seems to influence oral health on more than one level, affecting both health behaviour and outcomes. People with certain personality characteristics, such as NA, are more likely to engage in health-risk behaviours (Krueger et al., 2000); increasing the likelihood of oral-related health problems. The association between smoking and personality is one example of such a relationship. Studies have consistently linked the likelihood of being a current smoker and nicotine addiction (Terracciano and Costa, 2004; Munafò and Black, 2007; Munafò et al., 2007; Kahler et al., 2009) to scoring high on negative affectivity scales (Breslau et al., 1993; Kawakami et al., 2000; McChargue et al., 2004). Thomson et al. (2011a) found that scoring high on negative emotionality is a risk factor for clinical disease status. The study reported a strong association between negative emotionality and a greater number of untreated, decayed surfaces and tooth loss due to caries.

Thomson et al. (2011a) showed that certain personality traits may predispose to poor oral health. Psychological factors, for example, have been consistently related to temporomandibular disorders (TMD; Moss and Adams, 1984; McCrerey et al., 1991). Certain personality characteristics, such as having high levels of neuroticism or anxiety, have been implicated in the aetiology of TMD (Callahan, 2000; Meldolesi et al., 2000). Findings from the VA Normative study/Dental Longitudinal Study found that, the personality factors of dependence and neuroticism were negatively associated with tooth brushing (Kressin et al., 1995).

Finally, personality research is considered important in understanding the psychopathology of mental and emotional disturbances (Kotov et al., 2007). Watson and Clark (1988b) reported a strong correlation between anxiety and NA, but not with PA. NA seems to be positively correlated with all anxiety disorders (Watson, 1999), because anxiety is considered as one of the central features of NA (Watson and Clark, 1984). Dental anxiety, in particular, is of interest to dental and oral health practitioners. The aetiology of dental anxiety has been linked to personality characteristics (Kreuger et al., 1996). Some theories explaining severe forms of dental anxiety eminate from its relation to psychological characteristics. Personality traits, such as trait anxiety and NA were reported to be more prevalent among dentally anxious patients (Hägglin et al., 2001; Lago-Me´ndez et al., 2006). It has been demonstrated that dentally anxious patients are more likely to engage in thoughts of negative nature, and therefore catastrophise dental events (de Jongh and Ter Horst 1993, 1995; Wardle, 1984).
2.5.3 The importance of studying personality effects on oral health

The relation between negative personality traits and oral health could point towards a public health burden, because significantly more medical and dental visits could be expected from people with high NA and this is likely to drain medical and dental resources (Costa and McCrae, 1987).

The association of psychological (such as personality) with oral self-care behaviours was investigated by a few authors. Research showed that cognitive interventions were successful in improving oral health behaviour (Bailey et al., 1981; McCaul et al., 1992). Furthermore, Leventhal (1985) suggested that, in risky health behaviour changing (such as in smoking cessation), person's interpretations of symptoms may determine long-term change of behavior. Because personality characteristics are central to the health perception process, this emphasizes the need to further investigate this association, because it could prove helpful in altering behaviour. Kressin et al. (1999) suggested that understanding the individual personality characteristics associated with oral self-care may be utilised to improve the effectiveness of oral health education. Recently, Turiano et al. (2011) suggested that personality-related interventions aiming to reduce the negative health behaviours associated with neuroticism warrant consideration. Furthermore, research into personality traits could predict future health outcomes (Moffit et al., 2011). Another novel yet interesting idea that could be useful in the clinical dental setting is to investigate the relationship between psychological traits and the impact of different therapies on patients’ satisfaction. For example, NA has been found to be associated with a decreased level of satisfaction with treatments such as implant therapy (Kiyak et al., 1990; Al-Omiri et al., 2012). It might be worth investigating personality profiles of patients to assess their suitability for dental treatment thus saving on time, cost, and preventing complications associated with treatment.

2.5.4 An overview of the literature on personality and oral health

Research is beginning to focus on the relationship between psychological characteristic and oral health. There is some evidence that personality influences oral health on a multitude of levels, such as its effect on oral self-care behaviours (Kressin et al., 1999) and OHRQoL (Kressin, 2001). An association that has only been recently investigated is one that looks into how individuals with certain personality characteristics self-report their oral health. Because
personality can act as a confounder when subjective indices of OHRQoL are used, a need to control for personality factors has been suggested to get more accurate assessments of OHRQoL (Thomson et al., 2011a). To date, there is little information on the possible role of personality in shaping oral health reports. Furthermore, there are no studies to date that have used a short personality questionnaire, such as the PANAS, alongside other measures of self-reported oral health.
Chapter III: Methods

3.1 Introduction

This thesis describes a cross-sectional study that served as the first investigation of the association of personality characteristics with self-reported oral health measures in an adult New Zealand sample. It also aimed to report on the prevalence of xerostomia and dental anxiety, and to explore their association with OHRQoL. A new dental anxiety scale (the IDAF-4C; Armfield, 2010b) was also tested for its validity and reliability in this New Zealand sample.

The methods which were used in this study are described in terms of: the study design, the sample, ethical approval, data collection, questionnaire design, data collection and confidentiality, and the statistical tests used in data analysis.

3.2 Study design

A cross-sectional descriptive epidemiological of a New Zealand adult population survey was undertaken for this study.

3.3 The sample

The Dunedin South Electoral Roll (obtained from the Electoral Enrolment Centre, Wellington) was used as a sampling frame. The sample was randomly drawn (using SPSS) from the South Dunedin Electoral Roll, which represented approximately 57,407 people, in an area which includes southern suburbs of the Dunedin urban area, including Green Island and Fairfield, the Otago Peninsula, and the communities of Brighton, Mosgiel, Allanton and Outram (Appendix A). The required sample size was calculated using data from the 2009 National Oral Health Survey. Among adults in the target age range, the prevalence of xerostomia was 13.2% (95% CI 11.2, 15.5). Among non-xerostomics, the mean OHIP-14 score was 4.0 (SE 0.2); among xerostomics, it was 6.6 (SE 0.9). Assuming a conservative effect size of 0.2 and 95% power to detect a difference, the likely sample size to demonstrate such a difference was estimated to be 314. Assuming a 60% response rate, the required sample size was therefore calculated to be 523.
3.4 Māori consultation, ethical approval, and informed consent

Māori consultation was undertaken. The Ngāi Tahu Consultation Committee letter is attached as Appendix B. Ethnicity data was collected as a part of the research project in response to the committee’s recommendations.

Ethical approval was attained from the University of Otago Human Ethics Committee (Appendix C).

Informed consent was not considered necessary, because it was considered that respondents would simply imply consent through their agreement to take part in the study and posting back the completed questionnaire. However, a cover letter (Appendix D) and an information sheet (Appendix E) were a part of the questionnaire. These informed the respondents of the nature and the aims of the survey. They also made the respondents aware of who would handle the data and that the data may be published. The participants were informed that participation in the study was purely voluntary and that they were able to withdraw at any stage without any disadvantage.

3.5 Questionnaire design

The self-report questionnaire (Appendix F) used in the study comprised 84 items. These were divided into six groups of variables: (1) socio-demographic characteristics; (2) oral and general health care; (3) oral health impact; (4) self-reported xerostomia; (5) self-reported dental anxiety; (6) and positive and negative affect (PA, NA).

3.5.1 Socio-demographic characteristics

The socio-demographic characteristics used in the study were based on a previous investigation by Dixon et al. (1999) on a New Zealand population group. These included:

(1) Age and gender;
(2) Ethnic group (please tick all which apply) (European, Māori, Pacific Islander, Asian or other);
(3) Community Services Card (CSC) ownership (the CSC is a card that is issued to help low- to middle-income New Zealand residents pay less for prescriptions and some health services; essentially, it is another marker of low SES).
(4) Education level (primary school, secondary school, trades qualification, tertiary); and
(5) Occupation (or prior occupation if respondent was retired).

For each of the above items, respondents were asked to circle the appropriate answer, which was numerically coded for data entry.

Socio-economic status (SES) was estimated for each participant using the Socio-economic Index 2006 (NZSEI-06; Milne, 2012) which employs a six-interval classification, and provides an occupationally derived indicator of socioeconomic status. For the purposes of the analyses in this study, the six NZSEI-06) categories were collapsed into three, giving low-, medium-, and high- SES groups.

3.5.2 Oral and general health care variables

Respondents were asked a number of questions concerning their oral and general health characteristics, including their:

(1) Presence of own remaining teeth;
(2) The expectation of teeth lasting for life;
(3) Denture wearing (full denture, partial plastic denture, partial metal denture);
(4) Expectation of the need to wear a denture at any stage;
(5) Usual reason for visiting a dentist (check-up or problem);
(6) Time since last visit for dental care;
(7) Reason for their last dental visit (pain, broken filling or tooth, gum problems, denture problems or check-up);
(8) Frequency of brushing;
(9) Mouthwash usage;
(10) Frequency of flossing; and
(11) Smoking status (smoker, non-smoker).

Respondents were asked to circle the most appropriate answer, which was numerically coded for data entry. The questionnaire is presented in Appendix F.
3.5.3 Oral health impact variables

The OHIP-14 (Slade, 1997b), a 14-item scale that describes the impact of oral conditions on people’s daily lives was utilised in the current study. Furthermore, Locker’s global measure for rating OHRQoL (“How would you describe the health of your mouth? Excellent, Very good, Good, Fair, Poor”) and another global rating of the respondents’ relative oral health status (All things considered, would you say that, over the past year, the health of your mouth has: Improved, Stayed the same, Got worse”) was included. These single-item measures were used to provide a standard measure against which other instruments assessing the different aspects of oral health in the questionnaire can be compared. Respondents were requested to circle the most appropriate answers which were entered directly into the database.

3.5.4 Instruments investigating xerostomia

The Shortened Xerostomia Inventory (SXI), a 5-item scale relating to xerostomia experience (Thomson et al., 2011b) was used to explore dry mouth symptoms. This is a multi-item scale for measuring the severity of the symptoms of dry mouth. The use of the SXI has potential benefits for both clinical oral medicine practice and for epidemiologic research looking into the condition (Thomson and Williams, 2000).

A single-item xerostomia measure (Thomson et al., 1993) was included in to test the instrument’s performance against an existing standard.

Respondents were requested to circle the most appropriate answers which were entered directly into the database.

3.5.5 Scales investigating dental anxiety

A new scale that measures dental anxiety, the IDAF-4C+ (Armfield, 2010c), was included in the questionnaire, to test its reliability and validity. The IDAF-4C+ has three modules which measure the four components of dental fear (Emotional component, Behavioural component, Physiological component, Cognitive component). The three modules are the core module (IDAF-4C), dental phobia (IADF-P), and potential anxiety inducing stimuli (IADF-S). Only the core module (IDAF-4C) was employed in the current study.
Corah’s Dental Anxiety Scale (DAS), the most widely used dental anxiety measure, was used as a second dental anxiety measure. It is a four-item scale with a five response categories for each question (Corah, 1969). The questions and response options for the DAS are presented in Appendix F. By summing the responses to the four questions, the DAS score represents the severity of the respondent’s dental anxiety.

Estimates of dental anxiety prevalence using the two scales were compared, using the standard cut points of 13 for the DAS and 3 for the IDAF-4C (Thomson et al., 1996). The DAS also served as one of the measures to assess the validity of the IDAF-4C.

Respondents were requested to circle the most appropriate answers. The responses were subsequently entered into the database.

### 3.5.6 Scale investigating positive affect and negative affect

The Positive and Negative Affect Schedule (PANAS), a scale that includes 10 items measuring positive affectivity (PA), and 10 items measuring negative affectivity (NA; Watson and Clark, 1984) was used to assess personality characteristics. The questions and response options to the PANAS are presented in Appendix F.

Respondents were requested to circle the most appropriate answers.

### 3.6 Data collection and confidentiality

Respondents’ confidentiality was safeguarded by the use of a coding system; the name of each respondent was entered into a database alongside an identity number. The identity number was used on the questionnaire, and in all data-entry forms. The personal data were kept securely by the co-investigator.

The questionnaire was sent with the cover letter, information sheet, and a free-post envelope. The cover letter requested that the participant be able to read and answer the provided questionnaire and was in the target age range for the study, which is 35-54 years. This age group was chosen on the basis of the most recent New Zealand Health Survey (MOH, 2010) that identified it as one with a high prevalence of oral health problems. Furthermore, little is known about this age group as it is not commonly researched. So, targeted individuals should have
been within that age range (or just above it because of the time since the Electoral Roll had been assembled).

Six weeks after the first mail-out, individuals who had not yet responded were sent an additional questionnaire and covering letter. Data collection ended four weeks after the second mail-out.

Incentives were used to increase the response rate to the questionnaire. Respondents were entered into a draw for a $200 supermarket voucher.

3.7 Statistical analyses

3.7.1 Dependent variables

Case definitions for dental anxiety
The following case definitions were used: (1) being dentally anxious according to the DAS was defined by scoring 13 or above on the total DAS score, (2) being dentally anxious according to the IDAF-4C was defined by scoring 3 or more on the mean IDAF-4C scale score, (3) being xerostomic was defined by a response of “Always” or “Frequently” on the standard xerostomia question.

Prevalence, extent and severity of OHRQoL
The prevalence of poor OHRQoL was estimated (at whole scale and subscale level) by calculating the percentage of respondents who experienced one or more OHIP-14 scale items “fairly often” or “very often”. The severity of OHRQoL was calculated as the mean OHIP-14 score or subscale score, by summing responses for all 14 items or for each of the seven dimensions, respectively (with a range of 0-56 across 14 items).

3.7.2 Data analysis

All questionnaire data were entered into SPSS (version 20 for Windows), in which most of the statistical analyses were conducted. Stata was used for multivariate analysis. The analysis began with the univariate description of the sample. Key socio-demographic characteristics were designated as categorical variables (all ordinal, except sex, which was nominal) in order to allow comparison between or among groups. Descriptive statistics were used to describe the sample characteristics. Continuous variables were described using means and standard deviations. Categorical variables were described as frequencies and percentages.
The scale scores were calculated. The mean scale score was computed for the IDAF-4C, whereas the total score (sum of scores for the responses to the four items) was calculated for the DAS. The associations between the two dental anxiety scales were examined using Pearson’s r correlation coefficient and a scatterplot.

Bivariate analyses of demographic characteristics, oral care characteristics, and dental visiting patterns of the participants by prevalence and severity of OHRQoL, xerostomia status, and dental anxiety status were conducted. Associations for continuous variables were tested for statistical significance using Analysis of Variance (ANOVA). Chi-square tests were used to examine the statistical significance of differences observed with categorical variables.

To test the validity of the IDAF-4C in the current study sample, exploratory factor analysis (EFA) was used, employing principal axis factoring (with promax rotation) as the extraction method, with Kaiser normalisation. This was followed by an assessment of the scale’s internal consistency using coefficient alpha. Confirmatory factor analysis using the Principal Components method was undertaken to examine the factor structure and reliability of the PANAS and the DAS.

Logistic regression modelling was used to examine the association of the and xerostomia with OHIP impact prevalence. This was done while controlling for gender, age, and low education level. Those covariates were chosen because they were found to be confounders in earlier studies, or they were found to be associated with the dependent variables in the bivariate analysis. Controlling for the same confounding factors, logistic regression modelling was also used to examine the associations between the IDAF-4C and PANAS. Negative binomial regression modelling was used to model the mean total OHIP-14 score, and the IDAF-4C continuous score because the dependent variables were not normally distributed.

In the presentation of the data in the Results section, only significant P values are indicated.

3.7.3 Missing data

Three questions on the PANAS NA and 8 for the PA scale were left unanswered. No questions were left unanswered for either the DAS or the IDAF-4C. Similarly, none were unanswered for the SXI or the standard xerostomia question. A total of five questions were left blank for the OHIP-14. In all cases, the missing values were recoded to the lowest possible one.
Chapter IV: Results

4.1 Socio-demographic characteristics

4.1.1 Participation details

Participation details are presented in Table 4.1.

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Raw percent</th>
<th>Included&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected</td>
<td>523</td>
<td>100.0</td>
<td>N/A</td>
</tr>
<tr>
<td>Replied</td>
<td>253</td>
<td>48.4</td>
<td>Yes</td>
</tr>
<tr>
<td>Did not reply</td>
<td>233</td>
<td>44.6</td>
<td>Yes</td>
</tr>
<tr>
<td>Returned to sender&lt;sup&gt;b&lt;/sup&gt;</td>
<td>32</td>
<td>6.1</td>
<td>No</td>
</tr>
<tr>
<td>Returned and declined</td>
<td>2</td>
<td>0.4</td>
<td>Yes</td>
</tr>
<tr>
<td>Deceased</td>
<td>2</td>
<td>0.4</td>
<td>No</td>
</tr>
<tr>
<td>Unable to complete due to disability</td>
<td>1</td>
<td>0.2</td>
<td>No</td>
</tr>
</tbody>
</table>

<sup>a</sup>No longer at the listed address
<sup>b</sup>In denominator for participation rate calculation

Of the 523 questionnaires which were originally sent, there were 32 households that could not be contacted by mail. These were considered to be “out of frame”, taking the effective sample down to 491.

Of the remainder, 253 were completed and returned; two indicated that they did not wish to participate in the study, and two had died. The participation rate for this study was computed as the total number of completed and returned questionnaires less those whose reason for not responding was unknown, divided by the participation rate. This was therefore calculated as 253 divided by 253 + 233 + 2, giving 51.8%.
4.1.2 Respondents’ characteristics

The age, sex, and ethnicity characteristics are presented by response status in Table 4.2. The socio-demographic information which was used in this Table came from the Electoral Roll details.

Table 4.2 Respondents’ characteristics by age group, ethnicity, and gender (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Response status (%)</th>
<th>All combined (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replied</td>
<td>Not replied</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group</th>
<th>Replied</th>
<th>Not replied</th>
<th>All combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-44</td>
<td>87 (34.4)</td>
<td>118 (50.2)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>205 (42.0)</td>
</tr>
<tr>
<td>45-54</td>
<td>166 (65.6)</td>
<td>117 (49.6)</td>
<td>283 (57.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Replied</th>
<th>Not replied</th>
<th>All combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Māori</td>
<td>14 (5.5)</td>
<td>11 (4.7)</td>
<td>25 (5.1)</td>
</tr>
<tr>
<td>Non-Māori</td>
<td>239 (94.5)</td>
<td>224 (95.3)</td>
<td>463 (94.9)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Replied</th>
<th>Not replied</th>
<th>All combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>143 (56.5)</td>
<td>102 (49.8)</td>
<td>245 (50.2)</td>
</tr>
<tr>
<td>Male</td>
<td>110 (43.5)</td>
<td>103 (50.0)</td>
<td>213 (43.6)</td>
</tr>
</tbody>
</table>

| All combined | 253 (51.8) | 235 (48.2) | 488 (100.0) |

<sup>a</sup>P<0.05

The age of the participants ranged from 35 to 54, with a mean age of 46.8 (SD = 5.2), and a median age of 47 years. There was a higher proportion of female responders, while there were similar proportions of males and females among those who did not respond. A significantly higher proportion of responders was observed among the older age group of 45 to 54.

There was no difference in response rate by ethnicity. The majority of the respondents were non-Māori. Because of the small number of Māori respondents in the sample, no further analyses used ethnicity as an explanatory variable. Similarly, the age group was not used as an explanatory variable in subsequent analyses because the entire 35-53 age group was the focus of the study.
4.1.3 Sample description

The study participants’ demographic characteristics are presented in Table 4.3.

Table 4.3 Participants’ socio-demographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th></th>
<th>Sex</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female Number (%)</td>
<td>Male Number (%)</td>
<td>All combined Number (%)</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>70 (71.4)</td>
<td>28 (28.6)a</td>
<td>98 (38.7)</td>
<td></td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>17 (30.9)</td>
<td>38 (61.9)</td>
<td>55 (21.7)</td>
<td></td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>56 (56.0)</td>
<td>44 (44.0)</td>
<td>100 (39.5)</td>
<td></td>
</tr>
<tr>
<td>SES group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>50 (66.7)</td>
<td>25 (33.3)a</td>
<td>75 (29.6)</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>56 (47.1)</td>
<td>63 (52.9)</td>
<td>119 (47.0)</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>37 (62.7)</td>
<td>22 (37.3)</td>
<td>59 (23.3)</td>
<td></td>
</tr>
<tr>
<td>CSC holder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>110 (54.2)</td>
<td>93 (45.8)</td>
<td>203 (80.2)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>33 (66.0)</td>
<td>17 (34.0)</td>
<td>50 (19.8)</td>
<td></td>
</tr>
<tr>
<td>All combined</td>
<td>143 (56.5)</td>
<td>110 (43.5)</td>
<td>253 (100.0)</td>
<td></td>
</tr>
</tbody>
</table>

*aP<0.05

Overall, there were similar proportions of those respondents educated to university level and school level. Most of the university degree holders and the higher SES group were females. Males made up the highest proportion of trade or polytechnic qualification (vocational education and training, offering a range of New Zealand accredited degrees, diplomas and certificates) holders. One in five respondents had a CSC, and nearly twice as many females as males held a CSC.
4.2 Oral care characteristics

This section presents data on oral care characteristics in terms of dental visiting, brushing, and smoking patterns.

4.2.1 Time since last dental visit

Data on dental visiting patterns are presented in Table 4.4.

Table 4.4 Time since last dental visit by socio-demographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th></th>
<th>In the last year</th>
<th>In the last two years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Did not make a dental visit</td>
<td>Made a dental visit</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>57 (39.9)</td>
<td>86 (60.1)</td>
</tr>
<tr>
<td>Male</td>
<td>50 (45.5)</td>
<td>60 (54.5)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>41 (41.8)</td>
<td>57 (58.2)</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>24 (43.6)</td>
<td>31 (56.4)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>42 (42.0)</td>
<td>58 (58.0)</td>
</tr>
<tr>
<td>SES group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>33 (44.0)</td>
<td>42 (56.0)</td>
</tr>
<tr>
<td>Medium</td>
<td>49 (41.2)</td>
<td>70 (58.8)</td>
</tr>
<tr>
<td>Low</td>
<td>25 (42.4)</td>
<td>34 (57.6)</td>
</tr>
<tr>
<td>CSC holder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>81 (39.9)</td>
<td>122 (60.1)</td>
</tr>
<tr>
<td>Yes</td>
<td>26 (52.0)</td>
<td>24 (48.0)</td>
</tr>
<tr>
<td>All combined</td>
<td>107 (42.3)</td>
<td>146 (57.7)</td>
</tr>
</tbody>
</table>

*P<0.05
Two-thirds of respondents had made a dental visit within the previous two years, while almost half had made a visit within the previous year. There were no sex differences in visiting patterns. There was a significant difference in visiting patterns by CSC status, whereby a lower proportion of CSC holders than non-CSC holders had visited in the previous 24 months.

4.2.2 Association between usual reason for visit and last dental visit

Data on the relationship between dental visiting patterns and reason for dental visit are presented in Table 4.5.

Table 4.5 Associations between dental visiting patterns and time since last dental visit
(brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Made dental visit in last 12 months</th>
<th>No</th>
<th>Yes</th>
<th>All combined (col%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual reason for visit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check up</td>
<td>31 (22.1)</td>
<td>109 (77.9)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>140 (55.3)</td>
</tr>
<tr>
<td>Problem or never go</td>
<td>76 (67.3)</td>
<td>37 (32.7)</td>
<td>113 (44.7)</td>
</tr>
<tr>
<td>All combined</td>
<td>107 (42.3)</td>
<td>146 (57.7)</td>
<td>253 (100.0)</td>
</tr>
</tbody>
</table>

<sup>a</sup>P<0.05

Just under half of the respondents were episodic visitors. More than three-quarters of those who usually visited for a check-up had made a dental visit within the previous 12 months. On the other hand, two-thirds of those who did not visit the dentist within the preceding 12 months reported that they visited for a problem or never went. These differences were statistically significant.
4.2.3 Brushing frequency and smoking

Data on self-reported smoking status and brushing frequency are presented in Table 4.6.

Table 4.6 Brushing frequency and smoking status by socio-demographic characteristics
(brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th></th>
<th>Brushing frequency</th>
<th>Current smoker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than once daily</td>
<td>At least once daily</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>5 (3.5)</td>
<td>138 (96.5)</td>
</tr>
<tr>
<td>Male</td>
<td>9 (8.2)</td>
<td>101 (91.8)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>6 (6.1)</td>
<td>92 (93.9)</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>2 (3.6)</td>
<td>53 (96.4)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>6 (6.0)</td>
<td>94 (94.0)</td>
</tr>
<tr>
<td><strong>SES group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>5 (6.7)</td>
<td>70 (93.3)</td>
</tr>
<tr>
<td>Medium</td>
<td>5 (4.2)</td>
<td>114 (95.8)</td>
</tr>
<tr>
<td>Low</td>
<td>4 (6.8)</td>
<td>55 (93.2)</td>
</tr>
<tr>
<td><strong>CSC holder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>10 (4.9)</td>
<td>193 (95.1)</td>
</tr>
<tr>
<td>Yes</td>
<td>4 (8.0)</td>
<td>46 (92.0)</td>
</tr>
<tr>
<td><strong>All combined</strong></td>
<td>14 (5.5)</td>
<td>239 (94.5)</td>
</tr>
</tbody>
</table>

*P<0.05

Almost all participants brushed at least once daily. A higher proportion of males, those with trades/polytechnic education, and those with a CSC brushed less than once daily. However, there were no statistically significant differences.

Fewer than one-fourth of the participants reported being current smokers. A statistically significant gradient was noticed by education level and SES. Those in the low education group were almost three times more likely to be current smokers than those in the university-educated
group. On the other hand, respondents of low SES were four times more likely to smoke than those in the high SES group.

4.3 Self-reported oral health

4.3.1 Self-reported oral health by socio-demographic characteristics

Data on responses to the Locker item by socio-demographic characteristics are shown in Table 4.7.

<table>
<thead>
<tr>
<th>Table 4.7 Self-reported oral health by socio-demographic characteristics (brackets show percentages unless otherwise indicated)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-reported oral health</strong></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
</tr>
<tr>
<td>University</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
</tr>
<tr>
<td>Primary or secondary</td>
</tr>
<tr>
<td><strong>SES group</strong></td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td><strong>CSC holder</strong></td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td><strong>All combined</strong></td>
</tr>
</tbody>
</table>

\(^a\)P<0.05
Over one-third of participants reported their oral health to be ‘Excellent’ or ‘Very good’, while fewer than one in five rated their oral health to be ‘Fair’ or ‘Poor’. More females than males described their oral health as ‘Excellent’ or ‘Very good’. A statistically significant education and SES gradient was observed in ‘Excellent/Very good’ self-reported oral health. “Excellent/Very good” oral health was almost twice as common among those without a CSC.

4.3.2 Self-reported oral health by oral care characteristics

Data on self-reported oral health using the Locker item are presented by dental care characteristics in Table 4.8.
Table 4.8 Self-reported oral health by dental care characteristics (brackets show percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Dental care characteristics</th>
<th>Self-reported oral health</th>
<th>Self-reported oral health</th>
<th>Self-reported oral health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent/Very good</td>
<td>Good</td>
<td>Fair/Poor</td>
</tr>
<tr>
<td>Self-care</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brushing frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than once/day</td>
<td>5 (35.7)</td>
<td>7 (50.0)</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>At least once/day</td>
<td>98 (41.2)</td>
<td>98 (41.2)</td>
<td>42 (17.6)</td>
</tr>
<tr>
<td>Dental visiting pattern</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routine</td>
<td>83 (59.3)</td>
<td>48 (34.3)</td>
<td>9 (6.4) (^a)</td>
</tr>
<tr>
<td>Episodic</td>
<td>20 (17.9)</td>
<td>57 (50.9)</td>
<td>35 (31.2)</td>
</tr>
<tr>
<td>Visited with in last 12 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>36 (34.0)</td>
<td>43 (40.6)</td>
<td>27 (25.5) (^b)</td>
</tr>
<tr>
<td>Yes</td>
<td>67 (45.9)</td>
<td>62 (42.5)</td>
<td>17 (11.6)</td>
</tr>
<tr>
<td>Visited within the last 24 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>14 (24.1)</td>
<td>26 (44.8)</td>
<td>18 (31.0) (^b)</td>
</tr>
<tr>
<td>Yes</td>
<td>89 (45.9)</td>
<td>79 (40.7)</td>
<td>26 (13.4)</td>
</tr>
<tr>
<td>Reason for dental visit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check-up</td>
<td>83 (59.3)</td>
<td>48 (34.3)</td>
<td>9 (6.4) (^b)</td>
</tr>
<tr>
<td>Problem or never go</td>
<td>20 (17.9)</td>
<td>57 (50.9)</td>
<td>35 (31.2)</td>
</tr>
<tr>
<td>All combined</td>
<td>103 (40.9)</td>
<td>105 (41.7)</td>
<td>44 (17.5)</td>
</tr>
</tbody>
</table>

\(^{a}P<0.001\)

\(^{b}P<0.05\)
Most participants who brushed at least once daily rated their oral health as ‘good’, ‘very good’ or ‘excellent’. There were significant associations between self-reported oral health and dental characteristics for both frequency of and reason for dental visiting. A higher percentage of those who had not visited the dentist within the previous one or two years, and those whose reason for visit was “going for a problem or never go”, reported ‘fair’ or ‘poor’ oral health.

4.4 Oral health-related quality of life (OHRQoL)

4.4.1 Prevalence and severity of OHIP-14 total impacts by socio-demographic characteristics

Data on the prevalence and severity of OHIP-14 impacts by socio-demographic characteristics are presented in Table 4.9.

Table 4.9 Severity and prevalence of OHIP-14 impacts by socio-demographic characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Severity&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Prevalence&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>10.4 (7.9)</td>
<td>28 (19.6)&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Male</td>
<td>11.3 (8.3)</td>
<td>33 (30.0)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>9.4 (6.8)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>20 (20.4)</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>9.9 (8.0)</td>
<td>9 (16.4)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>12.6 (9.0)</td>
<td>32 (32.0)</td>
</tr>
<tr>
<td>SES group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>9.1 (6.5)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>14 (18.7)&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Medium</td>
<td>10.6 (7.8)</td>
<td>20 (24.2)</td>
</tr>
<tr>
<td>Low</td>
<td>13.3 (9.8)</td>
<td>23 (39.0)</td>
</tr>
<tr>
<td>CSC holder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>10.4 (7.8)</td>
<td>43 (21.2)&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Yes</td>
<td>12.5 (9.1)</td>
<td>18 (36.0)</td>
</tr>
<tr>
<td>All combined</td>
<td>10.8 (8.1)</td>
<td>61 (24.1)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Mean OHIP-14 score (sd)
<sup>b</sup>Number reporting 1+ impacts fairly/very often (%)
<sup>c</sup>P<0.05
A quarter of the sample reported one or more OHIP-14 impacts. Males had a statistically significant higher prevalence of OHIP impacts. A statistically significant SES gradient was seen for impact prevalence and severity, whereas for education level, such a gradient was detected only for the severity of OHIP-14 impacts. A significant association was observed between impact prevalence and holding a CSC.

### 4.4.2 Prevalence and severity of OHIP-14 subscale/domain impacts

Mean scores and impact prevalence in the seven domains of OHIP-14 questionnaire are presented in Table 4.10.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Prevalence: no. reporting 1+ impacts fairly/very often</th>
<th>Severity: mean scale score (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional limitation</td>
<td>9 (3.6)</td>
<td>0.8 (1.4)</td>
</tr>
<tr>
<td>Physical pain</td>
<td>20 (7.9)</td>
<td>2.2 (1.6)</td>
</tr>
<tr>
<td>Psychological discomfort</td>
<td>31 (12.3)</td>
<td>1.9 (1.9)</td>
</tr>
<tr>
<td>Physical disability</td>
<td>24 (9.5)</td>
<td>1.8 (1.5)</td>
</tr>
<tr>
<td>Psychological disability</td>
<td>24 (9.5)</td>
<td>1.7 (1.7)</td>
</tr>
<tr>
<td>Social disability</td>
<td>17 (6.7)</td>
<td>1.5 (1.6)</td>
</tr>
<tr>
<td>Handicap</td>
<td>6 (2.4)</td>
<td>0.9 (1.2)</td>
</tr>
<tr>
<td>Overall OHIP-14</td>
<td>61 (24.1)</td>
<td>10.8 (8.1)</td>
</tr>
</tbody>
</table>

The highest prevalence of impacts was observed with the psychological discomfort subscale, followed by psychological and physical disability. The least experienced dimension was handicap. On the other hand, the most severe dimension (that is, the highest mean score) was physical pain, and the least severe was handicap.

### 4.4.3 Prevalence of OHIP-14 subscale/domain impacts by socio-demographic characteristics

Data on the prevalence of OHIP-14 subscale/domain impacts by socio-demographic characteristics are shown in Table 4.11.
Table 4.11 Prevalence of subscale OHIP-14 impacts (‘often’ or ‘very often’) by socio-demographic characteristics (brackets contain percentages unless indicated)

<table>
<thead>
<tr>
<th>OHIP-14 subscale</th>
<th>Functional limitation</th>
<th>Physical pain</th>
<th>Psychological discomfort</th>
<th>Physical disability</th>
<th>Psychological disability</th>
<th>Social disability</th>
<th>Handicap</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>3 (2.1)</td>
<td>12 (8.4)</td>
<td>15 (10.5)</td>
<td>10 (7.0)</td>
<td>13 (9.1)</td>
<td>7 (4.9)</td>
<td>3 (2.1)</td>
</tr>
<tr>
<td>Male</td>
<td>6 (5.5)</td>
<td>8 (7.3)</td>
<td>16 (14.5)</td>
<td>14 (12.7)</td>
<td>11 (10.0)</td>
<td>10 (9.1)</td>
<td>3 (2.7)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>0 (0.0)</td>
<td>5 (5.1)</td>
<td>11 (11.2)</td>
<td>5 (5.1)</td>
<td>7 (7.1)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3 (3.1)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1 (1.0)</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>3 (5.5)</td>
<td>4 (7.3)</td>
<td>6 (10.9)</td>
<td>5 (9.1)</td>
<td>3 (5.5)</td>
<td>2 (3.6)</td>
<td>1 (1.8)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>6 (6.0)</td>
<td>11 (11.0)</td>
<td>14 (14.0)</td>
<td>14 (14.0)</td>
<td>14 (14.0)</td>
<td>12 (12.0)</td>
<td>4 (4.0)</td>
</tr>
<tr>
<td><strong>SES group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0 (0.0)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4 (5.3)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8 (10.7)</td>
<td>3 (4.0)</td>
<td>4 (5.3)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2 (2.7)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0 (0.0)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Medium</td>
<td>3 (2.5)</td>
<td>6 (5.0)</td>
<td>10 (8.4)</td>
<td>12 (10.1)</td>
<td>8 (6.7)</td>
<td>7 (5.9)</td>
<td>2 (1.7)</td>
</tr>
<tr>
<td>Low</td>
<td>6 (10.2)</td>
<td>10 (16.9)</td>
<td>13 (22.0)</td>
<td>9 (15.3)</td>
<td>12 (20.3)</td>
<td>8 (13.6)</td>
<td>4 (6.8)</td>
</tr>
<tr>
<td><strong>CSC holder</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5 (2.5)</td>
<td>12 (5.9)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>22 (10.8)</td>
<td>19 (9.4)</td>
<td>15 (7.4)</td>
<td>9 (4.4)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3 (1.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>4 (8.0)</td>
<td>8 (16.0)</td>
<td>9 (18.0)</td>
<td>5 (10.0)</td>
<td>9 (18.0)</td>
<td>8 (16.0)</td>
<td>3 (6.0)</td>
</tr>
</tbody>
</table>

<sup>a</sup>P<0.05
A significant association was observed between education level and psychological and social disability, with a higher impact prevalence among those educated to primary or secondary school level. A significant association also existed between SES group and the prevalence of impacts in functional limitation, physical pain, psychological disability, social disability, and handicap, with the highest prevalence among the low-SES group. Ownership of a CSC was associated with physical pain, psychological and social disability, with a higher prevalence among CSC holders.

4.4.4 Mean subscale OHIP-14 scores by socio-demographic characteristics

Table 4.12 shows the mean OHIP-14 scores by socio-demographic characteristics.
Table 4.12 Mean OHIP-14 scores by socio-demographic characteristics (brackets contain standard deviations unless otherwise indicated)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Functional limitation</th>
<th>Physical pain</th>
<th>Psychological discomfort</th>
<th>Physical disability</th>
<th>Psychological disability</th>
<th>Social disability</th>
<th>Handicap</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.7 (1.2)</td>
<td>2.2 (1.6)</td>
<td>1.8 (1.9)</td>
<td>1.6 (1.5)(^a)</td>
<td>1.8 (1.7)</td>
<td>1.5 (1.5)</td>
<td>0.9 (1.2)</td>
</tr>
<tr>
<td>Male</td>
<td>1.0 (1.6)</td>
<td>2.3 (1.6)</td>
<td>1.9 (1.8)</td>
<td>2.0 (1.6)</td>
<td>1.6 (1.7)</td>
<td>1.5 (1.6)</td>
<td>0.9 (1.3)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>0.3 (0.7)(^a)</td>
<td>2.1 (1.5)</td>
<td>1.8 (1.9)</td>
<td>1.5 (1.4)(^a)</td>
<td>1.7 (1.7)</td>
<td>1.3 (1.4)</td>
<td>0.7 (1.0)</td>
</tr>
<tr>
<td>Trade/polytechnic</td>
<td>0.9 (1.3)</td>
<td>2.3 (1.7)</td>
<td>1.7 (1.7)</td>
<td>1.8 (1.5)</td>
<td>1.5 (1.7)</td>
<td>1.3 (1.4)</td>
<td>0.7 (1.1)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>1.2 (1.8)</td>
<td>2.4 (1.6)</td>
<td>2.0 (2.0)</td>
<td>2.1 (1.6)</td>
<td>1.9 (1.8)</td>
<td>1.7 (1.8)</td>
<td>1.2 (1.4)</td>
</tr>
<tr>
<td><strong>SES group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>0.4 (0.8)(^a)</td>
<td>2.1 (1.5)</td>
<td>1.7 (1.8)</td>
<td>1.4 (1.4)</td>
<td>1.6 (1.6)</td>
<td>1.3 (1.3)</td>
<td>0.7 (1.0)</td>
</tr>
<tr>
<td>Medium</td>
<td>0.8 (1.3)</td>
<td>2.3 (1.6)</td>
<td>1.8 (1.7)</td>
<td>2.6 (9.1)</td>
<td>1.7 (1.7)</td>
<td>1.5 (1.5)</td>
<td>0.8 (1.2)</td>
</tr>
<tr>
<td>Low</td>
<td>1.4 (2.0)</td>
<td>2.3 (1.7)</td>
<td>2.3 (2.3)</td>
<td>2.1 (1.7)</td>
<td>2.1 (1.9)</td>
<td>1.8 (1.8)</td>
<td>1.3 (1.5)</td>
</tr>
<tr>
<td><strong>CSC holder</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0.7 (1.3)(^a)</td>
<td>2.3 (1.6)</td>
<td>1.8 (1.8)</td>
<td>1.7 (1.5)</td>
<td>1.7 (1.7)</td>
<td>1.4 (1.5)</td>
<td>0.8 (1.2)</td>
</tr>
<tr>
<td>Yes</td>
<td>1.3 (1.6)</td>
<td>2.2 (1.7)</td>
<td>2.0 (2.1)</td>
<td>2.0 (1.6)</td>
<td>2.0 (1.8)</td>
<td>1.9 (1.8)</td>
<td>1.1 (1.4)</td>
</tr>
</tbody>
</table>

\(^a\)P<0.05
Other than for physical disability (where males had higher mean scores), there were no significant associations between gender and the seven OHIP-14 subscale scores. A statistically significant gradient was observed in scores for functional limitation by education level, SES group, and holding a CSC card. A significant association was observed between education level and the mean subscale score for physical disability and handicap, with a higher mean score among the primary/secondary education group. A gradient was also observed between SES group and handicap, with higher mean scores among the low SES group. Having a CSC was associated with functional limitation, with a higher mean score among CSC holders.

4.5 Self-reported xerostomia

4.5.1 Validity of the Summated Xerostomia Inventory (SXI)

Table 4.13 presents mean SXI scores by responses to the standard xerostomia question.

<table>
<thead>
<tr>
<th>Standard xerostomia response category</th>
<th>Mean SXI score (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>5.6 (0.9)a</td>
</tr>
<tr>
<td>Occasionally</td>
<td>7.3 (1.5)</td>
</tr>
<tr>
<td>Frequently</td>
<td>8.4 (1.7)</td>
</tr>
<tr>
<td>Always</td>
<td>15.0 (0.0)</td>
</tr>
<tr>
<td>Xerostomia status</td>
<td></td>
</tr>
<tr>
<td>Never/Occasionally (non-xerostomic)</td>
<td>6.7 (1.5)a</td>
</tr>
<tr>
<td>Frequently/Always (xerostomic)</td>
<td>9.1 (2.6)</td>
</tr>
</tbody>
</table>

*P<0.05

Mean SXI scores were greater among those who reported more severe xerostomia symptoms using the standard xerostomia question. Xerostomics had statistically significant higher mean SXI scores.
### 4.5.2 Self-reported xerostomia by socio-demographic characteristics

Data on respondents’ self-reported xerostomia status and severity are presented in Table 4.14.

<table>
<thead>
<tr>
<th></th>
<th>Xerostomic (%)</th>
<th>Mean SXI score (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>135 (94.4)</td>
<td>8 (5.6)</td>
</tr>
<tr>
<td>Male</td>
<td>99 (90.0)</td>
<td>11 (10.0)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>92 (93.9)</td>
<td>6 (6.1)</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>52 (94.5)</td>
<td>3 (5.5)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>90 (90.0)</td>
<td>10 (10.0)</td>
</tr>
<tr>
<td><strong>SES group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>70 (93.3)</td>
<td>5 (6.7)</td>
</tr>
<tr>
<td>Medium</td>
<td>113 (95.0)</td>
<td>6 (5.0)</td>
</tr>
<tr>
<td>Low</td>
<td>51 (86.4)</td>
<td>8 (13.6)</td>
</tr>
<tr>
<td><strong>CSC holder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>191 (94.1)</td>
<td>12 (5.9)</td>
</tr>
<tr>
<td>Yes</td>
<td>43 (86.0)</td>
<td>7 (14.0)</td>
</tr>
<tr>
<td><strong>All combined</strong></td>
<td>234 (92.5)</td>
<td>19 (7.5)</td>
</tr>
</tbody>
</table>

*P<0.05

One in thirteen participants reported feeling dry mouth frequently or always. A statistically significant difference was observed in CSC holders in relation to reporting xerostomia, with almost one in seven CSC holders (but only one in sixteen non-CSC holders) reporting xerostomia. Although the difference was not statistically significant, the prevalence of xerostomia was higher among males. A statistically significant gradient in mean SXI score was observed by education level, SES group, and holding a CSC.
4.5.3 Association of xerostomia with oral-health-related-quality-of-life (OHRQoL)

4.5.3.1 Association of xerostomia with oral-health-related-quality-of-life (OHRQoL) by overall OHIP-14 score

Data on the prevalence of OHIP impacts are presented by xerostomia status in Table 4.15.

Table 4.15 Prevalence of 1+ overall OHIP-14 impacts by xerostomia status (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Xerostomic</th>
<th>No (%)</th>
<th>Yes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any OHIP-14 impacts?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>184 (50.0)</td>
<td>8 (42.1)(^a)</td>
</tr>
<tr>
<td>Yes</td>
<td>50 (21.4)</td>
<td>11 (57.9)</td>
</tr>
<tr>
<td>All combined</td>
<td>192 (75.9)</td>
<td>61 (24.1)</td>
</tr>
</tbody>
</table>

\(^a\)P<0.05

More than half of those with xerostomia reported one or more impacts “often” or “very often”. The prevalence of OHIP-14 impacts was higher among xerostomics. These differences were statistically significant.
4.5.3.2 Prevalence of subscale OHIP-14 impacts (‘very often’ or ‘fairly often’) by xerostomia status

Table 4.16 presents data on the prevalence of OHIP-14 subscale impacts by xerostomia.

Table 4.16 Prevalence of 1+ OHIP-14 subscale impacts (‘very often or ‘fairly often’) by xerostomia status (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>No (%)</th>
<th>Yes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional limitation</td>
<td>8 (3.4)</td>
<td>1 (5.3)</td>
</tr>
<tr>
<td>Physical pain</td>
<td>16 (6.8)</td>
<td>4 (21.1)</td>
</tr>
<tr>
<td>Psychological discomfort</td>
<td>26 (11.1)</td>
<td>5 (26.3)</td>
</tr>
<tr>
<td>Physical disability</td>
<td>21 (9.0)</td>
<td>3 (15.8)</td>
</tr>
<tr>
<td>Psychological disability</td>
<td>18 (7.7)</td>
<td>6 (31.6)*</td>
</tr>
<tr>
<td>Social disability</td>
<td>14 (6.0)</td>
<td>3 (15.8)</td>
</tr>
<tr>
<td>Handicap</td>
<td>4 (1.7)</td>
<td>2 (10.5)</td>
</tr>
</tbody>
</table>

*P<0.05

A higher prevalence of OHIP-14 impacts was observed in xerostomics across all OHIP-14 dimensions, although the difference was statistically significant only for psychological disability.
4.5.3.3 *Severity of OHIP-14 impacts by mean OHIP-14 combined and subscale scores*

Data on OHIP-14 total and subscale scores are presented by xerostomia status in Table 4.17.

**Table 4.17 Mean overall and subscale OHIP-14 scores by xerostomia status (brackets contain percentages unless otherwise indicated)**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>No (sd)</th>
<th>Yes (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall OHIP-14 score</td>
<td>10.2 (7.7)</td>
<td>17.1 (9.6)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.7 (1.3)</td>
<td>1.9 (2.0)</td>
</tr>
<tr>
<td>Physical pain</td>
<td>2.1 (1.6)</td>
<td>3.3 (1.5)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Psychological discomfort</td>
<td>1.8 (1.9)</td>
<td>2.9 (1.9)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Physical disability</td>
<td>1.7 (1.5)</td>
<td>2.4 (1.8)</td>
</tr>
<tr>
<td>Psychological disability</td>
<td>1.7 (1.7)</td>
<td>2.5 (1.9)</td>
</tr>
<tr>
<td>Social disability</td>
<td>1.4 (1.5)</td>
<td>2.4 (1.6)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Handicap</td>
<td>0.8 (1.1)</td>
<td>1.6 (1.9)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup><sup>P<0.05</sup>

Xerostomics had significantly higher overall mean OHIP-14 scores, and they also had higher mean subscale scores for physical pain, psychological discomfort social disability, and handicap dimensions of OHIP-14.
4.6 Dental anxiety

4.6.1 Confirmatory factor analysis (CFA) for the DAS

Table 4.18 presents the confirmatory factor analysis (CFA) for DAS.

<table>
<thead>
<tr>
<th>Item</th>
<th>Single factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you had to go to the dentist tomorrow, how would you feel about it?</td>
<td>0.816</td>
</tr>
<tr>
<td>When you are waiting in the dentist’s surgery for your turn in the chair, how do you feel?</td>
<td>0.920</td>
</tr>
<tr>
<td>When you are waiting in the dentist’s chair while he gets his drill ready to begin working on your teeth, how do you feel?</td>
<td>0.896</td>
</tr>
<tr>
<td>You are waiting in the dentist’s chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments which he will use to scrape your teeth around the gums, how do you feel?</td>
<td>0.895</td>
</tr>
</tbody>
</table>

The outcome of the confirmatory factor analysis for the DAS revealed that the items loaded were on a single factor, and that the loadings were acceptably high. The analysis also revealed only one Eigenvalue that was greater than 1, at 3.1. That single factor explained 77.9% of the variance in DAS responses.
4.6.2 Exploratory factor analysis (EFA) for IDAF-4C

Table 4.19 presents the exploratory factor analysis (EFA) for IDAF-4C.

Table 4.19 EFA for the IDAF-4C

<table>
<thead>
<tr>
<th>Item</th>
<th>Single factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel anxious shortly before going to the dentist.</td>
<td>0.688</td>
</tr>
<tr>
<td>I generally avoid going to the dentist because I find the experience unpleasant or distressing.</td>
<td>0.724</td>
</tr>
<tr>
<td>I get nervous or edgy about upcoming dental visits.</td>
<td>0.802</td>
</tr>
<tr>
<td>I think that something really bad would happen tomorrow if I were to visit a dentist.</td>
<td>0.518</td>
</tr>
<tr>
<td>I feel afraid or fearful when visiting the dentist.</td>
<td>0.776</td>
</tr>
<tr>
<td>My heart beats faster when I go to the dentist.</td>
<td>0.723</td>
</tr>
<tr>
<td>I delay making appointments to go to the dentist.</td>
<td>0.430</td>
</tr>
<tr>
<td>I often think about all the things that might go wrong prior to going to the dentist.</td>
<td>0.503</td>
</tr>
</tbody>
</table>

The outcome of the exploratory factor analysis for the IDAF-4C revealed that loadings were on a single factor, and that they were acceptably high. The analysis also showed only one Eigen value that was greater than 1, at 5.2. That single factor explained 65.0% of the variance in IDAF-4C responses.

4.6.3 Individual responses to dental anxiety scales (the DAS and the IDAF-4C)

Data on the distribution of responses to each of the DAS and the IDAF-4C items are presented in Appendix D.
4.6.4 Validity of the IDAF-4C

4.6.4.1 Concordance between the IDAF-4C and the DAS scores

Figure 4.1 presents a scatterplot of the IDAF-4C and the DAS scores.

![Figure 4.1 Scatter plot for the IDAF-4C and the DAS](image)

The scatter plot for the association between the IDAF-4C and the DAS shows a moderate correlation. The Pearson $r$ correlation coefficient between the IDAF-4C and the DAS measures was calculated at 0.782. This was statistically significant at $p<0.001$. 
4.6.4.2 Dental visiting patterns by prevalence of dental anxiety (using IDAF-4C)

Table 4.20 presents data on dental visiting patterns by dental anxiety prevalence.

Table 4.20 Dental visiting patterns by dental anxiety prevalence (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Visiting pattern</th>
<th>Prevalence of dental anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Episodic</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>23 (20.4)\textsuperscript{a}</td>
</tr>
<tr>
<td>No</td>
<td>10 (7.1)</td>
</tr>
<tr>
<td>Made dental visit in last 12 months</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11 (7.5)\textsuperscript{a}</td>
</tr>
<tr>
<td>No</td>
<td>22 (20.6)</td>
</tr>
<tr>
<td>Made last dental visit in last 24 months</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14 (23.7)</td>
</tr>
<tr>
<td>No</td>
<td>19 (9.8)</td>
</tr>
</tbody>
</table>

\textsuperscript{a}P<0.05

Episodic visitors, and those who did not visited the dentist within the previous year were three times more likely to be dentally anxious than regular dental visitors or those who had not made a visit within the previous year.
4.6.4.3  Dental visiting patterns by mean DAS and mean IDAF-4C scores

Mean DAS and mean IDAF-4C scores are presented by visiting patterns in Table 4.21.

Table 4.21 Mean DAS and IDAF-4C scores by dental visiting patterns

<table>
<thead>
<tr>
<th>Visiting pattern</th>
<th>Mean DAS score (sd)</th>
<th>Mean IDAF-4C score (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Episodic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9.8 (3.4)</td>
<td>2.2 (1.0)</td>
</tr>
<tr>
<td>No</td>
<td>8.6 (3.5)</td>
<td>1.6 (0.8)</td>
</tr>
<tr>
<td>Made dental visit in last 12 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>8.8 (3.4)</td>
<td>1.7 (0.8)</td>
</tr>
<tr>
<td>No</td>
<td>9.7 (3.6)</td>
<td>2.2 (1.0)</td>
</tr>
<tr>
<td>Made last dental visit in last 24 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>8.9 (3.5)</td>
<td>1.8 (0.9)</td>
</tr>
<tr>
<td>No</td>
<td>9.9 (3.3)</td>
<td>2.3 (0.9)</td>
</tr>
</tbody>
</table>

*P<0.001  

Mean scores for both the DAS and the IDAF-4C were higher among episodic visitors and those who did not make a dental visit within the last 12 months. These differences were statistically significant at the 0.05 level for the DAS, but at the 0.001 level for the IDAF-4C.
4.6.5 Prevalence of dental anxiety

Using a cut-off point of 13 (of the summated score) for DAS, and 3 (of the mean score) for IDAF-4C, the prevalence rates for dental anxiety were estimated at 18.8% and 13.0%, respectively. About half of the 18.6% determined to be dentally anxious using the DAS were also determined to be so using the IDAF-4C (Table 4.22).

Table 4.22 Concordance between the DAS and the IDAF-4C in respect of dental anxiety prevalence (brackets contain total percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Dentally anxious using the IDAF-4C</th>
<th>No</th>
<th>Yes</th>
<th>Both combined&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>196 (77.5)</td>
<td>24 (9.5)</td>
<td>220 (87.0)</td>
</tr>
<tr>
<td>Yes</td>
<td>10 (4.2)</td>
<td>23 (9.1)</td>
<td>33 (13.0)</td>
</tr>
<tr>
<td>Both combined&lt;sup&gt;c&lt;/sup&gt;</td>
<td>206 (81.4)</td>
<td>47 (18.6)</td>
<td>253 (100.0)</td>
</tr>
</tbody>
</table>

<sup>a</sup>Column %
<sup>b</sup>Kappa = 0.50
<sup>c</sup>Row %

For identifying the prevalence of dental anxiety, the kappa statistic indicated there was only moderate concordance between the two measures.

Table 4.23 presents data on the prevalence of dental anxiety using DAS and IDAF-4C, by socio-demographic characteristics.
### Table 4.23 Prevalence of dental anxiety (using DAS, and IDAF-4C), by socio-demographic characteristics (brackets contain percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Dentally anxious using the DAS</th>
<th>Dentally anxious using the IDAF-4C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes (percentage)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>101 (70.6)</td>
<td>42 (29.4)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Male</td>
<td>105 (95.5)</td>
<td>5 (4.5)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>76 (77.6)</td>
<td>22 (22.4)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Trade/polytechnic</td>
<td>52 (94.5)</td>
<td>3 (5.5)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>78 (78.0)</td>
<td>22 (22.0)</td>
</tr>
<tr>
<td>SES group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>58 (77.3)</td>
<td>17 (22.7)</td>
</tr>
<tr>
<td>Medium</td>
<td>103 (86.6)</td>
<td>16 (13.4)</td>
</tr>
<tr>
<td>Low</td>
<td>45 (76.3)</td>
<td>14 (23.7)</td>
</tr>
<tr>
<td>CSC holder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>167 (82.3)</td>
<td>36 (17.7)</td>
</tr>
<tr>
<td>Yes</td>
<td>39 (78.0)</td>
<td>11 (22.0)</td>
</tr>
<tr>
<td>All combined</td>
<td>206 (81.4)</td>
<td>47 (18.6)</td>
</tr>
</tbody>
</table>

<sup>a</sup>P<0.05

Using the DAS, one in three females were identified as being dentally anxious, but it was only one in five when using the IDAF-4C. On the other hand, the prevalence rates for males were similar between the two scales, with one in 22 males reporting being dentally anxious. In both cases, females had a statistically significant higher prevalence of dental anxiety. There were no apparent differences by any of the other socio-demographic characteristics.
4.6.6 Mean DAS and mean IDAF-4C scores by socio-demographic characteristics

Table 4.24 presents data on the mean DAS and mean IDAF-4C scores by socio-demographic characteristics.

**Table 4.24 Mean DAS and mean IDAF scores by socio-demographic characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mean DAS score (sd)</th>
<th>Mean IDAF-4C score (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>10.2 (3.7)a</td>
<td>17.0 (8.6)a</td>
</tr>
<tr>
<td>Male</td>
<td>7.8 (2.7)</td>
<td>13.0 (5.2)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>9.6 (3.9)</td>
<td>15.7 (8.6)</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>8.7 (2.9)</td>
<td>14.1 (6.6)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>9.1 (3.4)</td>
<td>15.5 (7.0)</td>
</tr>
<tr>
<td><strong>SES group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>9.7 (3.9)</td>
<td>16.1 (8.9)</td>
</tr>
<tr>
<td>Medium</td>
<td>8.7 (3.1)</td>
<td>14.3 (6.2)</td>
</tr>
<tr>
<td>Low</td>
<td>9.3 (3.8)</td>
<td>16.0 (8.2)</td>
</tr>
<tr>
<td><strong>CSC holder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>9.1 (3.4)</td>
<td>14.9 (7.3)</td>
</tr>
<tr>
<td>Yes</td>
<td>9.5 (3.8)</td>
<td>16.6 (8.8)</td>
</tr>
<tr>
<td><strong>All combined</strong></td>
<td>9.2 (3.5)</td>
<td>15.2 (7.6)</td>
</tr>
</tbody>
</table>

*aP<0.05

Females had significantly higher mean DAS and IDAF-4C scores than males. No gradient was observed with education level or SES groups. Mean scores using both scales were higher for CSC holders than for non-holders, although this was not statistically significant.
4.6.7 Association between dental anxiety and OHRQoL

4.6.7.1 Mean total OHIP-14 scores by dental anxiety status using IDAF-4C

Table 4.25 presents data on the impact of dental anxiety on total OHIP-14 scores.

Table 4.25 Mean total OHIP-14 scores by dental anxiety status

<table>
<thead>
<tr>
<th>Dimension</th>
<th>No (sd)</th>
<th>Yes (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall OHIP-14 score</td>
<td>10.4 (7.5)</td>
<td>13.5 (11.0)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>0.8 (1.3)</td>
<td>1.2 (1.9)</td>
</tr>
<tr>
<td>Physical pain</td>
<td>2.2 (1.6)</td>
<td>2.8 (1.8)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Psychological discomfort</td>
<td>1.8 (1.7)</td>
<td>2.5 (2.6)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Physical disability</td>
<td>1.8 (1.5)</td>
<td>1.7 (1.6)</td>
</tr>
<tr>
<td>Psychological disability</td>
<td>1.7 (1.7)</td>
<td>2.3 (2.1)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Social disability</td>
<td>1.5 (1.5)</td>
<td>1.7 (1.7)</td>
</tr>
<tr>
<td>Handicap</td>
<td>0.8 (1.7)</td>
<td>1.3 (1.6)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>P<0.05

Overall, dentally anxious participants had higher mean overall OHIP-14 scores. They also had higher mean scores across all seven dimensions of the scale except for physical disability. A significant association was observed between being dentally anxious and mean total OHIP-14 scores. In addition, a significant association was also observed for physical pain, psychological discomfort psychological disability, and handicap mean scores, with those reporting dental anxiety having higher mean subscale OHIP-14 scores.
### 4.6.7.2 Prevalence of subscale OHIP-14 impacts (‘very often’ or ‘fairly often’) by dental anxiety status

Table 4.26 presents data on the prevalence of OHIP-14 subscale impacts by dental anxiety status.

**Table 4.26 Prevalence of 1+ OHIP-14 total and subscale impacts (‘very often’ or ‘fairly often’) by dental anxiety status (brackets contain percentages unless otherwise indicated)**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>No (%)</th>
<th>Yes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any 1+ OHIP-14 impacts</td>
<td>52 (23.6)</td>
<td>9 (27.3)</td>
</tr>
<tr>
<td>Functional limitation</td>
<td>7 (3.2)</td>
<td>2 (6.1)</td>
</tr>
<tr>
<td>Physical pain</td>
<td>15 (6.8)</td>
<td>5 (15.2)</td>
</tr>
<tr>
<td>Psychological discomfort</td>
<td>24 (10.9)</td>
<td>7 (21.2)</td>
</tr>
<tr>
<td>Physical disability</td>
<td>20 (9.1)</td>
<td>4 (12.1)</td>
</tr>
<tr>
<td>Psychological disability</td>
<td>17 (7.7)</td>
<td>7 (21.2)</td>
</tr>
<tr>
<td>Social disability</td>
<td>16 (7.3)</td>
<td>1 (3.0)</td>
</tr>
<tr>
<td>Handicap</td>
<td>2 (0.9)</td>
<td>4 (12.1)</td>
</tr>
</tbody>
</table>

*P<0.05

Using the IDAF-4C to determine dental anxiety status, dentally anxious participants had a higher prevalence of OHIP-14 total impacts. A higher prevalence was also noted for all dimensions, except for social disability, where dentally anxious participants scored higher than their non-anxious counterparts.
### 4.7 Positive affect (PA) and negative affect (NA)

#### 4.7.1 Confirmatory factor analysis (CFA) for the PANAS

Table 4.27 presents confirmatory analysis data for the PANAS.

<table>
<thead>
<tr>
<th>Component</th>
<th>Factor 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Factor 2&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interested</td>
<td>0.774</td>
<td>-0.106</td>
</tr>
<tr>
<td>Excited</td>
<td>0.733</td>
<td>-0.050</td>
</tr>
<tr>
<td>Strong</td>
<td>0.766</td>
<td>-0.081</td>
</tr>
<tr>
<td>Enthusiastic</td>
<td>0.855</td>
<td>-0.112</td>
</tr>
<tr>
<td>Proud</td>
<td>0.714</td>
<td>-0.118</td>
</tr>
<tr>
<td>Alert</td>
<td>0.712</td>
<td>-0.083</td>
</tr>
<tr>
<td>Inspired</td>
<td>0.836</td>
<td>-0.058</td>
</tr>
<tr>
<td>Determined</td>
<td>0.821</td>
<td>-0.035</td>
</tr>
<tr>
<td>Attentive</td>
<td>0.779</td>
<td>-0.048</td>
</tr>
<tr>
<td>Active</td>
<td>0.658</td>
<td>-0.121</td>
</tr>
<tr>
<td>Distressed</td>
<td>-0.061</td>
<td>0.723</td>
</tr>
<tr>
<td>Upset</td>
<td>-0.020</td>
<td>0.757</td>
</tr>
<tr>
<td>Guilty</td>
<td>-0.082</td>
<td>0.682</td>
</tr>
<tr>
<td>Scared</td>
<td>-0.011</td>
<td>0.788</td>
</tr>
<tr>
<td>Hostile</td>
<td>-0.167</td>
<td>0.518</td>
</tr>
<tr>
<td>Irritable</td>
<td>-0.026</td>
<td>0.575</td>
</tr>
<tr>
<td>Ashamed</td>
<td>-0.112</td>
<td>0.595</td>
</tr>
<tr>
<td>Nervous</td>
<td>-0.067</td>
<td>0.753</td>
</tr>
<tr>
<td>Jittery</td>
<td>-0.121</td>
<td>0.721</td>
</tr>
<tr>
<td>Afraid</td>
<td>-0.089</td>
<td>0.784</td>
</tr>
</tbody>
</table>

<sup>a</sup>Cronbach’s $\alpha = 0.92$; eigen value = 6.0; percentage variance explained = 29.8

<sup>b</sup>Cronbach’s $\alpha = 0.88$; eigen value = 4.9; percentage variance explained = 24.6

The outcome of the confirmatory factor analysis revealed two underlying principal components, factor 1 representing the PA, and factor 2 representing NA. The factor loadings were acceptably high. The analysis also showed two eigen values greater than 1.
4.7.2 The relation between the PANAS PA and PANAS NA

Figure 4.2 presents a scatterplot of PANAS NA and PANAS PA scores.

![Scatter plot for PANAS PA and PANAS NA](image)

**Figure 4.2 Scatter plot for PANAS PA and PANAS NA**

The non-structured appearance of the scatter plot indicates that PANAS PA and PANAS PA are largely independent variables, and this was confirmed in the low correlation \( r = -0.21 \) between the two.
4.7.3 Mean PANAS scores by socio-demographic characteristics

Table 4.28 presents mean PA and NA scores by socio-demographic characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Mean PA score (sd)</th>
<th>Mean NA score (sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>33.5 (7.8)</td>
<td>18.9 (6.7)</td>
</tr>
<tr>
<td>Male</td>
<td>32.3 (8.2)</td>
<td>17.3 (5.6)</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>34.5 (7.6)</td>
<td>19.2 (6.7)</td>
</tr>
<tr>
<td>Trade/Polytechnic</td>
<td>32.9 (7.6)</td>
<td>16.9 (5.2)</td>
</tr>
<tr>
<td>Primary or secondary</td>
<td>31.4 (8.0)</td>
<td>17.9 (6.3)</td>
</tr>
<tr>
<td><strong>SES group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>35.0 (7.2)</td>
<td>18.9 (6.7)</td>
</tr>
<tr>
<td>Medium</td>
<td>32.7 (7.8)</td>
<td>17.5 (6.0)</td>
</tr>
<tr>
<td>Low</td>
<td>33.0 (8.8)</td>
<td>18.7 (6.3)</td>
</tr>
<tr>
<td><strong>CSC holder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>33.3 (7.8)</td>
<td>18.0 (6.2)</td>
</tr>
<tr>
<td>Yes</td>
<td>31.4 (8.7)</td>
<td>19.1 (6.7)</td>
</tr>
<tr>
<td><strong>All combined</strong></td>
<td>33.0 (8.0)</td>
<td>18.2 (6.3)</td>
</tr>
</tbody>
</table>

*P<0.05

There were no statistically significant socio-demographic differences in mean NA scores. On the other hand, mean PA scores showed significant differences by education level and SES group.

4.8 Regression models

In the models which follow, the PANAS data are used as continuous variables, so that the odds ratios (and IRRs) for those refer to a unit change in score.
4.8.1 Logistic regression model for the prevalence of 1+ OHIP-14 impacts

Variables which were significantly associated with the mean OHIP score in the bivariate analysis were entered into the multivariate models.

Table 4.29 presents the logistic regression model for 1+ OHIP-14 impacts.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio (OR)</th>
<th>95% Confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female(^a)</td>
<td>0.46</td>
<td>0.23 to 0.92</td>
<td>0.027</td>
</tr>
<tr>
<td>Age</td>
<td>1.00</td>
<td>0.94 to 1.07</td>
<td>0.974</td>
</tr>
<tr>
<td>Low education</td>
<td>2.04</td>
<td>1.06 to 3.94</td>
<td>0.033</td>
</tr>
<tr>
<td>PANAS positive affect</td>
<td>0.94</td>
<td>0.91 to 0.98</td>
<td>0.006</td>
</tr>
<tr>
<td>PANAS negative affect</td>
<td>1.07</td>
<td>1.01 to 1.13</td>
<td>0.018</td>
</tr>
<tr>
<td>Xerostomic</td>
<td>3.46</td>
<td>1.18 to 10.12</td>
<td>0.024</td>
</tr>
<tr>
<td>IDAF-4C</td>
<td>1.03</td>
<td>0.99 to 1.07</td>
<td>0.171</td>
</tr>
<tr>
<td>Constant</td>
<td>0.33</td>
<td>0.01 to 10.3</td>
<td>0.525</td>
</tr>
</tbody>
</table>

\(^a\)Respective reference categories for categorical variables: male; trade/Polytechnic or higher education level; nonxerostomic

Four characteristics were associated with one or more OHIP-14 impacts. These were a low education level, PANAS positive affect, PANAS negative affect, and xerostomia. Xerostomics had three-and-a-half times the odds of having 1+ OHIP-14 impacts. Having a low education level was associated with higher odds of having an OHIP-14 impact.
4.8.2 Negative binomial regression model for the mean OHIP-14 total score

Table 4.30 presents the negative binominal regression model for OHIP-14 total score.

<table>
<thead>
<tr>
<th></th>
<th>IRR(^a)</th>
<th>95% Confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>0.85</td>
<td>0.70 to 1.03</td>
<td>0.112</td>
</tr>
<tr>
<td>Age</td>
<td>1.01</td>
<td>0.99 to 1.03</td>
<td>0.261</td>
</tr>
<tr>
<td>Low education</td>
<td>1.30</td>
<td>1.08 to 1.60</td>
<td>0.007</td>
</tr>
<tr>
<td>PANAS positive affect</td>
<td>1.00</td>
<td>0.98 to 1.01</td>
<td>0.431</td>
</tr>
<tr>
<td>PANAS negative affect</td>
<td>1.03</td>
<td>1.02 to 1.05</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Xerostomia</td>
<td>1.45</td>
<td>1.02 to 2.05</td>
<td>0.038</td>
</tr>
<tr>
<td>IDAF-4C</td>
<td>1.01</td>
<td>1.00 to 1.03</td>
<td>0.051</td>
</tr>
<tr>
<td>Constant</td>
<td>3.25</td>
<td>1.14 to 9.29</td>
<td>0.028</td>
</tr>
</tbody>
</table>

\(^a\)Incidence rate ratio
\(^b\)Respective reference categories for categorical variables: male; trade/Polytechnic or higher education level; nonxerostomic

Xerostomias had a 45% higher score than non-xerostomics, while those with a low education level had a 30% higher score than those with a high level of education. Those with higher PANAS negative affect scores had higher OHIP-14 scores. There was no association between age group or PANAS positive affect and the mean OHIP-14 score.
4.8.3 Logistic regression model for dental anxiety (as defined by IDAF-4C)

Table 4.31 presents the logistic regression model for dental anxiety, defined using the IDAF-4C.

### Table 4.31 Logistic regression model for dental anxiety

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio (OR)</th>
<th>95% Confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female(^a)</td>
<td>4.25</td>
<td>1.55 to 11.67</td>
<td>0.005</td>
</tr>
<tr>
<td>Age</td>
<td>1.00</td>
<td>0.93 to 1.08</td>
<td>0.951</td>
</tr>
<tr>
<td>Low education</td>
<td>0.95</td>
<td>0.41 to 2.19</td>
<td>0.897</td>
</tr>
<tr>
<td>PANAS positive affect</td>
<td>0.99</td>
<td>0.94 to 1.05</td>
<td>0.802</td>
</tr>
<tr>
<td>PANAS negative affect</td>
<td>1.09</td>
<td>1.03 to 1.16</td>
<td>0.003</td>
</tr>
<tr>
<td>Constant</td>
<td>0.01</td>
<td>0.00 to 0.83</td>
<td>0.041</td>
</tr>
</tbody>
</table>

\(^a\)Incidence rate ratio
\(^b\)Reference categories categorical female variables: male; trade/Polytechnic or higher education level

Females had four times the odds than their male counterparts of being dentally anxious (OR =4.25, CI: 55-11.67). Similarly, having a higher score on PANAS negative affect was associated with higher odds of being dentally anxious (OR =1.09, 95% CI: 1.03-1.06).
4.8.4 Negative bionomial regression model for IDAF-4C

Table 4.32 presents the negative binominal regression model for the mean IDAF-4C continuous score.

Table 4.32 Negative binominal regression model for IDAF-4C continuous score

<table>
<thead>
<tr>
<th>IDAF-4C</th>
<th>IRR(^b)</th>
<th>95% Confidence interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female(^b)</td>
<td>1.28</td>
<td>1.14 to 1.42</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age</td>
<td>1.00</td>
<td>0.99 to 1.14</td>
<td>0.90</td>
</tr>
<tr>
<td>Low education</td>
<td>1.03</td>
<td>0.92 to 1.16</td>
<td>0.59</td>
</tr>
<tr>
<td>Panas positive affect</td>
<td>1.00</td>
<td>0.99 to 1.88</td>
<td>0.717</td>
</tr>
<tr>
<td>Panas negative affect</td>
<td>1.01</td>
<td>1.01 to 1.03</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Constant</td>
<td>9.16</td>
<td>5.06 to 16.56</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

\(^a\)Incidence rate ratio
\(^b\)Reference categories categorical female variables: male; trade/Polytechnic or higher education level

Females, on average, had an IDAF-4C score which was 28% higher than that of males. While for every unit “increase” in the Panas negative affect score, the IDAF-4C score was 1.7% higher. Those with higher Panas NA scores had higher IDAF-4C continuous scores. There was no association between age group, a low education level or PA with the continuous IDAF-4C score.
Chapter V: Discussion

5.1 Overview

The main objective of this study was to evaluate the association of personality characteristics with the perception of subjective oral health measures. More specifically, the association of the negative emotionality dimension of personality with OHRQoL, xerostomia and dental anxiety was investigated. The study also explored the prevalence of xerostomia and dental anxiety. To investigate the above-mentioned aims, the study used a survey. It incorporated questions on socio-demographic characteristics of the sample, their oral and general health care characteristics, a questionnaire on OHRQoL (OHIP-14), self-reported xerostomia (using SXI), and dental anxiety (using DAS and IDAF-4C).

The study aimed to build on earlier findings from the Dunedin Multidisciplinary Health and Development Study that suggested a link exists between NA and self-reported oral health (Thomson et al., 2011a). Using the Multi-dimensional Personality Questionnaire (MPQ), which consists of 177 questions measuring personality dimensions, that study suggested that individuals reporting more OHIP-14 impacts had higher NA scores. The current study was undertaken to further investigate these findings, and to validate the use of a short personality questionnaire (the PANAS, which consists of only twenty items) alongside self-reported measures of oral health so that the negative aspects of personality could be controlled in analyses of OHRQoL. It found that people scoring higher on NA were not only more likely to report a poorer OHRQoL, but were also more likely to report xerostomia and dental anxiety.

In the discussion which follows, the methodological issues will be considered first. The oral and self-care characteristics of the participants are discussed next. The discussion which follows that section has been organised according to the research questions. These were: (1) What evidence is there for the validity of the scales used in this study?; (2) what is the prevalence of xerostomia and how does it differ by socio-demographic and personality characteristics?; (3) is xerostomia associated with people’s self-reported oral health (OHIP-14, Locker’s global item) and do aspects of personality influence that association?; (4) What is the prevalence of dental anxiety and how does it differ by socio-demographic and personality characteristics?; (5) is dental anxiety associated with people’s self-reported oral health and do aspects of personality influence that association?; (6) Is the IDAF-4C a more valid way than Corah’s Dental Anxiety Scale to measure dental anxiety?
5.2 Methodological issues

Methodological issues pertaining to the study will be discussed in terms of the study design, the response rate, and the issue of sample representativeness.

5.2.1 Study design

A cross-sectional survey design was utilised in the current study. Cross-sectional studies are observational studies. Although easy and relatively inexpensive to conduct, these studies can establish only an association between a possible causative factor and a condition, rather than a “cause-and-effect” relationship (Sutherland, 2001). Had the financial resources and time allowed, a longitudinal study would have been more appropriate to capture the change in attitude and behaviour over time, enabling better identification of the relationships among the different variables.

5.2.2 Response rate

The study obtained an effective participation rate of 51.8%. This was lower than had been anticipated or hoped for. In a systematic review of the literature, Edwards (2002) investigated methods that influence response rates to postal questionnaires. Using monetary incentives more than doubled the response rates. Concurrently using personalised letters and pre-paid return envelopes and questionnaires of an interesting design, in addition to a second mail out to non-respondents were all associated with a higher response likelihood. Kanuk and Berenson (1975) described the types of effort that aim to increase response rates, classifying them into those that have to do with timing, such as letters of introduction and follow-up efforts, and those having to do with technique, such as questionnaire length, modification of the return envelope and postage, personalised letters, the colour of the questionnaire, ensuring anonymity of participants, and monetary incentives. The success of such techniques has been reported (Kanuk and Berenson, 1975; Edwards, 2002). All of the aforementioned methods were used in the current study. However, one of the difficulties that was encountered was the completeness and the currency of the sampling frame. There were technical difficulties associated with obtaining an approval for using the most recent Electoral Roll. Therefore, the Electoral Roll of 2011 (which was readily available) was used. As a result, 6.1% of the questionnaires were returned.
to sender because of an invalid address. Nevertheless, because the most recent Electoral Roll could not be used, the true percentage of return to sender cases could even be higher, and it was not possible to determine the extent of the effect of using an old Electoral Roll on non-response.

It is also possible that some respondents may be reluctant to participate in surveys of a sensitive nature (Edwards, 2002). The present study may have presented particular difficulties in this regard, because it contained questions about negative feelings such as being hostile or angry. Regardless of the reasons for non-response in the current study, and taking into consideration that almost one in two individuals in the selected population sample did not return their questionnaire, the issue of non-response is one that requires considerable analysis and attention. Locker and Grushka (1988) noted that estimating the effects of non-response in mailed surveys needs to be done in order to assess non-response bias. They pointed out that this is valuable to confirm that non-response bias does not lead to the integrity of the findings being compromised.

Non-response bias is a function of two main factors: the percentage of non-response; and the extent of systematic differences between the responders and the non-responders (Barclay, 2002). While high response rates in surveys are desirable, it has been suggested that low response rates do not necessarily lead to bias (Locker, 1993; Asch et al, 1997; Locker, 2000). For example, a study conducted by Locker (1993b) to specifically address the influence of non-response bias on prevalence estimates for oral conditions found that its effect was negligible. However, he suggested that this should not preclude the possibility of non-response bias whatever the participation rates were, and that its likelihood is greater with the greater non-response. It is therefore important to assess the differences between responders and non-responders to assess the magnitude of this type of bias. The information that can be obtained on non-responders is usually limited to socio-demographic data which are already contained in the sampling frame (Locker, 2000).

Applying these principles to the current study, the data presented in Table 4.2 suggest that, at least where age, ethnicity, and sex are concerned, there were no systematic differences. It is therefore possible to cautiously assert that the relatively low response rate did not have a markedly adverse effect on the findings.
5.2.3 Sample representativeness

The sample representativeness will be discussed in terms of comparison with data from the rest of country, and with local data.

The study sample was drawn from Dunedin for ease of data collection (such as the ease of telephone contact by participants with the investigators). The Dunedin South Electoral Roll was favoured over the Dunedin North Electoral Roll because of the transient nature of the latter; it is made up of a large proportion of students. It was felt that it would be difficult to achieve an adequate response rate in the latter electorate.

Data on the sex mix of participants in the current study, the Dunedin South Electorate (DSE, 2011), the Dunedin Multidisciplinary Health and Development Study (DMS; Thomson et al., 2011a), and New Zealand (Statistics New Zealand, 2013) are presented in Table 5.1.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Current study (%)</th>
<th>DSE (%)</th>
<th>DMHDS (%)</th>
<th>New Zealand (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>56.5</td>
<td>52.0</td>
<td>49.2</td>
<td>51.3^4</td>
</tr>
<tr>
<td>Male</td>
<td>43.5</td>
<td>48.0</td>
<td>50.8</td>
<td>48.7</td>
</tr>
</tbody>
</table>

The proportion of females in the current study sample was greater than that of the sampled population, and in New Zealand. Although females were over-represented in the current study, their proportion was not markedly different from that of the DSE, and they were less represented than in studies previously conducted in New Zealand. For example, the proportion of females in the West Coast Study (Dixon et al., 1999) was 61.1 %. Using the South Dunedin Electorate as a sampling frame, a higher proportion of females (who comprised 63.3 % of respondents) was also observed in a previous study of adult oral health (Jamieson and Thomson, 2006). Data on the ethnic distribution of participants in the current study, the Dunedin South Electorate (DSE, 2011), the Dunedin Multidisciplinary study (DMS; Shearer et al., 2012), and New Zealand (Statistics New Zealand, 2013)^4 are presented in Table 5.2.

Most of the university degree holders were females. On the other hand, males made up the highest proportion of trade or polytechnic qualification holders. This may, at least in part, explain females making up the highest percentage of the high SES group.

In summary, despite choosing the sample from the Electoral Roll, the sample cannot be considered to be fully representative of the 35-54 population. For example, female respondents, those aged 35 to 44, and Europeans were slightly over-represented. It is difficult to determine how a more representative sample could have been obtained. Some possible suggestions include: (1) using a more current Electoral Roll; (2) making the questionnaire content more interesting; (3) using a third mail-out; and (4) making follow-up phone calls to non-responders.

Table 5.2 Ethnicity data for the current study, DSE, DMS, and New Zealand

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Current study (%)</th>
<th>DSE (%)</th>
<th>DMHDS (%)</th>
<th>New Zealand (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maori</td>
<td>5.5</td>
<td>6.3</td>
<td>7.5</td>
<td>15.05</td>
</tr>
<tr>
<td>Non-Maori</td>
<td>94.5</td>
<td>93.7</td>
<td>92.5</td>
<td>85.0</td>
</tr>
</tbody>
</table>

5.3 Oral care and self-care characteristics

The following section explores the dental visiting patterns and oral hygiene and tobacco use characteristics of the study sample.

5.3.1 Dental visiting patterns

Not having received dental care in the previous year is considered to be an important indicator of irregular dental attendance (Kay, 1999; McGrath and Bedi, 2001). This definition, while meaningful, fails to assign the cause for seeking treatment to visiting patterns. Thus, while over three-quarters of the respondents in the current study reported check-ups as the usual reason for dental visiting, more than one-third of those also never visited the dentist or had last visited because of a problem. Therefore, the usual reason for dental visiting was used in the study to define episodic visitors; that is, those who were irregular attenders.

More than half of the respondents had visited the dentist in the 12 months preceding the survey. These visiting patterns were similar to those in the last national oral health survey (Ministry of Health, 2010), where 43.3% of the 35-44 age group and 55.7% of the 45-54 age group had made a dental visit within the previous year.

For those participants who had not visited within the 12 months preceding the survey, their dental visiting was mostly associated with dental problems. This pattern of attendance was more frequent in those who held a CSC, reflecting that the socio-economically disadvantaged population may face economic barriers in accessing dental care in the private sector. The other option for this group in Dunedin is Dental School clinics, which, in turn, suffer long waits for treatment. This may further explain the dental visiting patterns of those who hold a CSC.

5.3.2 Self-care

Information on dental and self-care is important when considering population oral health. In the current study, most respondents brushed once a day or more (96.5%). A similar estimate of 94.3% was reported from the last national oral health survey (Ministry of Health, 2010). Almost 1 in 28 participants brushed less than once a day, while about 1 in 20 did so in the 2009 survey (Ministry of Health, 2010). These similar estimates may further support the cautious assertion that the data may be representative (given the wide confidence intervals around the current study’s estimate).
5.3.3 Tobacco use characteristics

Although estimating smoking prevalence rates was not one of the main objectives of the study, it was worth investigating because of its implications for general and oral health. The smoking prevalence rate in the sample was 14.6%, which was less than that obtained by the 2013 New Zealand Government Census (Statistics New Zealand, 2013), which determined the current smoking rate to be at about 20% for the 35-54 age group. It was also less than that published by the last New Zealand Health Survey, which estimated the adult smoking rate to be within the 20.0% prevalence rate for the 30-49 age group (Ministry of Health, 2013). The slightly lower smoking prevalence obtained in the current study may be a reflection of the following: (1) the current study sample was under-represented with respect to Māori. The most recent New Zealand Health Survey found that Māori adult were much more likely to be current smokers than the rest of the population (two in five Māori, or 40%, were current smokers (Ministry of Health, 2013) (2) younger age groups (18 to 34) are more likely to be current smokers (Ministry of Health, 2010), than the older age groups (including the age group of 35-54 targeted in this study). Saying that, however, when the wide confidence intervals are considered in the current study (95% CI 10.0% to 19.2%), these differences may be less than is represented by the unadjusted prevalence rates.

5.4 Research questions

5.4.1 What evidence is there for the validity of the scales used in this study?

In this section, the validity of the PANAS and the SXI is discussed first, justifying their use in the study. This is followed by answers to the research questions.

5.4.1.1 What is the validity of the PANAS in the current study?

The PANAS was used to assess important and relevant aspects of personality. As such, it is important to first determine the scale’s validity in the current study sample. The psychometric properties of the PANAS are considered next, in order to validate its use in assessing personality characteristics in the current study.
Exploratory factor analysis is a useful statistical tool that allows researchers to evaluate the degree to which their measurement hypotheses are consistent with the actual data produced by participants using the scale. It allows discovering possible associations between different scale factors. In turn, a scale’s internal structure is relevant to its reliability, reflecting internal consistency by revealing which items are consistent with the other items within the scale (Thompson, 2004).

Exploratory factor analysis (EFA) was used to verify the factor structure of the PANAS in this sample. The EFA analysis revealed that a strong relationship existed between the scale items and their underlying latent constructs (labelled PA, NA). In other words, the analysis showed that the factor loadings for the two factors representing NA and PA were adequate. It also revealed no overlap between the two measured dimensions of NA and PA, emphasising that they are discrete entities. Therefore, all of the PANAS items were good markers of their corresponding factors. Interestingly, these primary factor loadings were, in fact, higher than those in the original data published by the scale developers (Watson et al., 1988a).

The internal consistency for the PANAS PA scale was high (Cronbach’s alpha= 0.92). Similarly, the reliability for the PANAS NA scale was good, with high internal consistency (Cronbach’s alpha= 0.88). The internal consistency values in the current study were higher than those obtained by the scale developers (0.86 to 0.90 for PA and from 0.84 to 0.87 for NA). Thus, the PANAS showed evidence of validity and reliability in the current study. The test-retest reliability of the PANAS (or any other measure in this study) was not examined, because it was felt that this would be an unwanted burden on the participants.

5.4.1.2 What is the validity of the short form xerostomia inventory in Dunedin?

Validity is an important inherent quality of scales that measure subjective symptoms (Thomson et al., 1999b). Examining a scale’s validity determines whether the scale in question is measuring what the researcher is really trying to measure. The key issue in examining the validity of the short form of the Xerostomia Inventory (SXI) is whether it assigns higher scores to respondents who complain of severe dry mouth symptoms. Concurrent validity in particular relates to examining a scale against an existing standard. In the current study, the validation of the SXI was done by examining the mean scale score across the four categories of the standard xerostomia question “How often does your mouth feel dry?” (Response options ‘Never’, ‘Occasionally’, ‘Frequently’ and ‘Always’). The observed gradients were in the right direction
and suggest that the SXI showed evidence of validity for assessing self-reported xerostomia on this population sample.

5.4.2 What is the prevalence of xerostomia and how does it differ by socio-demographic and personality characteristics?

A wide range of 12 to 47% of xerostomia prevalence rates has been reported in the literature (Thomson, 2005). The prevalence of perceived symptoms of dry mouth in the current study sample was 7.8%. A national epidemiological survey of adult New Zealanders found that the prevalence rate for xerostomia for the 35-44 age group was 9.5%, while, for the 45-54 age group, it was 14.2%. An overall xerostomia prevalence of 13.1% was reported (Benn, 2012). However, it is noteworthy that the former study found that individuals aged 75+ and those aged between 24 to 35 years had the highest odds of reporting xerostomia (Benn, 2012). Findings from the Dunedin Multidisciplinary Health and Development Study suggested that one in ten 32-year olds suffered xerostomia (Thomson et al., 2006). These differences in xerostomia prevalence in different studies can be explained by the different population samples, and the different age groups studied.

In the current study, the prevalence of xerostomia was higher in the lower education and SES groups. CSC holders also had higher prevalence and severity of xerostomia than non-CSC holders. This may be a reflection of the inverse relationship between SES, on the one hand, and the incidence and prevalence of disease on the other hand: the lower the SES, the greater is the occurrence of illnesses and their impacts (Amick, 1995).

In the negative binomial regression model, negative emotionality was the only significant factor associated with the severity of xerostomia (measured by the SXI score), meaning that individuals scoring higher on NA tended to report more severe xerostomia symptoms. This is not surprising, given the consistency of the association between NA and different kinds of health complaints (Blazer and Houpt, 1979; Costa and McCrae, 1980; Costa and McCrae, 1987; Clark and Watson, 1988; Watson, 1988; Watson and Pennebaker, 1989; Thomson et al., 2011a). The reports of more severe xerostomia coming from high NA individuals were consistent with that. These associations may be explained by those scoring high on NA trait being more likely to attend to their body stimuli or pain sensations (Watson, 1988). They are also more likely to be anxious and tend to recycle negative thoughts and interpret ambiguous symptoms in a threatening way (Watson and Clark, 1984).
5.4.3 Is xerostomia associated with people’s self-reported oral health and do aspects of personality influence that association?

There were significant associations between xerostomia and the severity of overall and subscale impacts (except for physical disability). The prevalence of 1+ impacts was higher for people with xerostomia than for people without xerostomia for each of the subscales (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap), but, the association was significant only for psychological disability. Furthermore, the negative binomial regression model revealed that xerostomia was significantly associated with the mean OHIP-14 score. People with xerostomia had 3.4 times the odds of experiencing one or more oral health impacts after controlling for NA. This confirms findings from the Dunedin Multidisciplinary Health and Development Study (DMHDS), which showed that xerostomia was not a trivial condition among 32-year-olds, with sufferers experiencing poorer oral-health-related quality of life (Thomson et al., 2006).

The regression models tested the influence of personality characteristics on the association between xerostomia and OHRQoL. Those scoring higher on negative emotionality were more likely to report xerostomia. This finding is in line with recent reports from the Dunedin Multidisciplinary Health and Development Study (DMHDS) that suggested that negative emotionality modified the relationship between OHRQoL and xerostomia (Thomson et al., 2006). The authors recommended the need for controlling for personality traits when examining the association between OHRQoL and subjective oral health measures such as xerostomia and dental anxiety (Thomson et al., 2011a), and recommended that the PANAS might be a suitable short scale for measuring personality characteristics in epidemiological surveys.

5.4.4 What is the prevalence of dental anxiety and how does it differ by socio-demographic and personality characteristics?

Using more than one scale to measure dental anxiety is advantageous, for more than one reason. First, the most widely used scales have limitations, mostly relating to their failure to embrace the contemporary knowledge of dental anxiety’s aetiology (Armfield, 2011). Second, the recently introduced dental fear scale by Armfield is one that requires further examination (Armfield, 2010b). For the most part, dental anxiety measures have placed little emphasis on the cognitive and behavioural manifestations of dental anxiety (Newton and Buck, 2000), which
seem to have been addressed by the IDAF-4C. For these mentioned reasons, the current study investigated the properties of the IDAF-4C (Armfield, 2010b) and used it alongside the DAS. This measure differs from its predecessors in terms of its sounder theoretical foundations. There was therefore a need to examine the new scale’s properties in a population-based sample outside its country of origin.

Information on prevalence rates for dental anxiety on a national level in New Zealand is sparse. In the current study, using a cut-off point of 13 for DAS, over one in six participants was classified as being dentally fearful. However, when a cut-off point of 3 for the IDAF-4C mean score was used, over one in eight participants were categorised as being such. It is worth noting that the occurrence of dental anxiety differs at different stages of the life (Thomson et al., 1997). Therefore, due to the lack of national-level data on dental anxiety prevalence in the 35-54 age group, a direct comparison with other data from New Zealand cannot be made. Saying that, however, the prevalence estimates for dental anxiety in the current study were similar to those from other studies. Using the DAS, Thomson et al. (1999c) found a 20.8% dental anxiety prevalence rate in on the West Coast of New Zealand’s South Island. The DMHDS found a prevalence rate of 21.1% among 26-year-olds, and of 18.4% for the same cohort at age 32 (Thomson et al., 2009).

The differences in prevalence obtained when using different dental anxiety measures were not surprising. Using different dental anxiety measures in the same study to evaluate the extent of this problem, Locker et al. (1996a) reported differences in prevalence rates between 8.2% and 23.4% (using the Gatchel fear scale and the Seattle study item, respectively). Armfield (2011) found that, using different measures, dental anxiety prevalence estimates ranged from as low as 7.3% to as high as 28.4%. It has also been noted that another reason for the variance in prevalence rates could be using different cut-offs (Locker et al., 1996a); it could also be due to the fact that different scales measure different constructs in different ways (Schuurs and Hoogstraten, 1993; Armfield, 2011).

Regardless of whether the DAS or the IDAF-4C was used, women were more likely to experience dental anxiety. An almost universal finding in the dental anxiety literature has been the greater prevalence of dental fear among females than males (Nederfors et al., 1993; Smyth, 1993; Holtzman et al., 1997; Liddell and Locker, 1997; Armfield, 2006; Heft et al., 2007). Some studies have shown that dental anxiety prevalence among females was twice as high as for males (Thomson et al., 1996; Locker, 2003b). In the regression models, the current study revealed an even higher likelihood of females having dental anxiety than males; women had 4.3 times the odds of being dentally anxious than men. Liddell and Locker (1997) suggested that
such differences are a reflection of women’s attitudes to pain and control; they reported more fear of pain and had a higher desire than men for control, but less perception of actual control.

When confounders were controlled for, scoring higher on NA was significantly associated with both being dentally anxious (defined using the IDAF-4C), and having higher IDAF-4C mean scores. This highlights the need to understand the role of negative thoughts (such as recycling negative experiences) in the maintenance of dental anxiety. Negative affectivity is a factor that deserves considerable attention when considering the aetiology of dental anxiety.

5.4.5 Is dental anxiety associated with people’s self-reported oral health and do aspects of personality influence that association?

The questionnaire used in this study included two dental anxiety measures. The DAS was included because it is still the most widely used instrument for measuring dental anxiety. The IDAF-4C was worth using because it was developed recently and has been attracting more interest as a potential alternative to the existing widely used (but flawed) dental anxiety instruments. Since its introduction, however, only a few studies to date have tested its validity on population samples; these were limited mainly to Australia (Armfield, 2010b).

Although OHRQoL measurement is emerging as an important tool in dental epidemiology and health services research, only a few researchers studied its impact on dental anxiety. This is an important topic, given the psychological impacts that dental anxiety has on those who suffer it.

In the current study, consistent differences were identified in OHRQoL between those categorised as dentally anxious and those who were not anxious. MacGrath and Bedi (2004) postulated that poor OHRQoL and dental anxiety concurred together as a result of underlying psychological characteristics (such as negative affectivity). Their study, however, did not measure and control for personality characteristics. In the present study, negative affectivity was associated with both dental anxiety and OHRQoL. A recent Finnish study of young adults (median age 22 years) examining the association between personality (using the NEO Personality Inventory, NEO-PI6; Costa & McCrae, 1992) and dental anxiety found that negative

---

6 Is a paper-and-pencil self-report measure based upon the popular five-factor model of trait personality (McCrae and Costa, 1987)
affectivity was a significant predictor of dental anxiety (Halonen et al., 2012). When dental anxiety was controlled for, the association between NA and OHRQoL persisted.

5.4.6 Is the IDAF-4C a more valid way than the DAS to measure dental anxiety?

The IDAF-4C, which is the core module of the IDAF-4C+, is used to determine the individual’s level of dental fear and anxiety. When discovering what exact aspect of the dental treatment is worrying to the patient, the stimulus module comes into use. The phobia module allows collection of additional information in cases where dental fear is believed to be associated with a psychiatric condition. Since the stimulus and phobia modules were not intended to be used as scales, but rather for epidemiological purposes (Armfield, 2011), the analyses presented in this work are limited to the core anxiety and fear module.

One objective of the current study was to report on the psychometric evaluation of this new dental fear instrument, and compare it against the most widely used dental anxiety scale, the DAS (Corah et al, 1969).

In the case of testing a dental anxiety scale, there is no “gold standard” against which to test the scale’s validity. Thus, the validity of the scale should be not be assessed on a single set of observations (Clark and Watson, 1995). Armfield (2010b) employed several methods to assess evidence for the validity of his new scale. These used: factor analysis; significant correlations with other dental anxiety measure; the ability of the scale scores to predict subsequent dental visiting; whether the visit was regarded as negative or positive experience; associations with visiting frequency; avoidance of the dentist due to dental fear; and fear of specific dental stimuli. The reliability of the test scores in the current study was assessed by measures of internal consistency. No test–retest reliability was attempted. The dental anxiety and fear module (designated the IDAF-4C) of the new scale demonstrated high internal consistency (Cronbach’s alpha= 0.92). The scale showed good evidence of validity in terms of having a moderately strong association with the DAS.
Table 5.3 Considering the validity of the IDAF-4C in the current study

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor structure</td>
<td>Yes</td>
</tr>
<tr>
<td>Association with the DAS</td>
<td>Yes</td>
</tr>
<tr>
<td>Higher scores among episodic visitors</td>
<td>Yes</td>
</tr>
<tr>
<td>Association with NA</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Although more population studies are needed to test the psychometric properties of the IDAF-4C, it is apparent from this study that this scale provides some evidence for validity and reliability. It is, therefore, concluded that it shows promise for use as a dental anxiety measure.
Chapter VI: Conclusions

This study is the first to use a short personality questionnaire alongside subjective oral health measures. Only a small number of studies have explored the influence of personality on oral health. Personality is of special interest when considering the manner in which people perceive and report on their oral health. Confirmation of the relation between negative emotionality and health will assist in understanding a public health burden, since significantly more medical and dental visits could be expected from people with such personality characteristics. People who tend to exaggerate their disease status are therefore expected to disproportionately use medical and dental resources (Costa and McCrae, 1987). Furthermore, healthcare researchers need to be aware that, when people’s views of their own health are coloured by their personality, overestimation of the prevalence of poor oral health may result. The study investigated the influence of personality characteristics on three subjective measures to do with oral health. These were OHRQoL, xerostomia, and dental anxiety.

Investigating personality in relation to dental anxiety is of interest because it has been implicated as a major factor in the development of the most severe forms of dental anxiety (Hägglin et al, 2001). The current study found that, after controlling for confounders, scoring high on NA was significantly associated with not only being dentally anxious but also having higher levels of dental anxiety.

Consistent differences in OHRQoL were identified between those categorised as dentally anxious and those who were not anxious. NA was associated with both being dentally anxious and having higher levels of dental anxiety. NA was also associated with poorer OHRQoL, as represented by OHIP-14 severity and impact prevalence. This highlights the fact that OHRQoL and dental anxiety, both being subjective experiences, may occur together as a result of common underlying psychological characteristics (such as negative affectivity).

Not only was xerostomia strongly associated with poorer OHRQoL, those scoring higher on negative emotionality were more likely to report xerostomia.

The study findings essentially point out that people’s views of their oral health may be coloured by their personality. Prevalence estimates using subjective oral health measures may therefore suffer a degree of “contamination” by personality characteristics. One difficulty in estimating the degree of this contamination, however, is that there are no cut-off point for defining cases when using personality measures. Thus, it is not possible to determine the prevalence of negative emotionality. Future research could be directed at addressing this issue.
In conclusion, oral health researchers need to be aware of the influence personality characteristics have when self-reported oral health measures are used, because an over-estimation of poor oral health may result. It is recommended that, where practicable, investigations of self-reported oral health should include a short measure of negative emotionality. This study has confirmed the utility of the PANAS in this respect.
References


Armfield JM (2010b). Development and psychometric evaluation of the Index of Dental Anxiety and Fear (IDAF-4C+) *Psychological Assessment* 22:279-87


Chavers LS, Gilbert GH, Shelton BJ (2002). Racial and socioeconomic disparities in oral
disadvantage, a measure of oral health-related quality of life: 24-month incidence. *Journal of


Cohen LK, Jago JD (1976). Toward the formulation of sociodental indicators. *International
Journal of Health Services* 6:681-98.

interventions targeting personality risk factors for youth alcohol misuse. *Journal of Clinical
Child and Adolescent Psychology* 35:550-63.

Cons NC, Jenny J, Kohout FJ (1986). DAI: The Dental Aesthetic Index, College of Dentistry,
University of Iowa, Iowa City.

general dental practitioners in the UK. *British Dental Journal* 162:77-81.


Costa PT Jr, McCrae RR (1980). Influence of extraversion and neuroticism on subjective well-

Costa PT Jr, McCrae RR (1985). Hypochondriasis, neuroticism, and aging: When are somatic

Costa, PT, McCrae RR (1987). Neuroticism, somatic complaints, and disease: is the bark worse

Costa PT, McCrae RR (1992). Revised neo personality inventory (NEO-PI-R) and neo five-
factor inventory (NEO-FFI). Odessa, FL: Psychological Assessment Resources.


Cushing AM, Sheiham A, Maizels J (1986). Developing socio-dental indicators--the social
impact of dental disease. *Community Dental Health* 3:3-17.


Appendices

Appendix A: Map of the Dunedin South Electorate Boundaries
Appendix B: Letter from Ngāi Tahu

NGĀI TAHU RESEARCH CONSULTATION COMMITTEE
Te Komiti Rakahau ki Kai Tahu

15/03/2012 - 13
Tuesday, 15 May 2012

Professor Thomson
Oral Sciences
Dunedin

I send Professor Thomson
Title: Personality and Self-Reported Oral Health.

The Ngāi Tahu Research Consultation Committee (The Committee) met on Tuesday, 15 May 2012 to discuss your research proposition.

By way of introduction, this response from the Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum, it states "Ngāi Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago." As such, this response is not "approval" or "mandate" for the research, rather it is a mandated response from a Ngāi Tahu-appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology: they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (is that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

As this study involves human participants, the Committee strongly encourage that ethnicity data be collected as part of the research project. That is the questions on self-identified ethnicity and descent: these questions are contained in the 2006 census.

The Committee suggests dissemination of the findings to relevant Māori health organisations. They note the collaboration with Professor John Doughton.

We wish you every success in your research and the Committee also requests a copy of the research findings.

The Ngāi Tahu Research Consultation Committee has membership from:
Te Rūnanga o Otago incorporated
Kāi Huia an Rauko te Pōtini
Te Rūnanga o Māori
This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 15 May 2012 to 15 November 2013.

The recommendations and suggestions above are provided on your proposal submitted through the consultation website process. These recommendations and suggestions do not necessarily relate to ethical issues with the research, including methodology. Other committees may also provide feedback in these areas.

Nāhaku noa, nā

Mark Brunton
Kaitakawaenga Rangahau Māori
Facilitator Research Māori
Research Division
Te Whare Wānanga o Otago
Ph: +64 3 479 8738
email: mark.brunton@otago.ac.nz
Web: www.otago.ac.nz
Appendix C: Letter of ethical approval

12/341

Professor W M Thomson
Department of Oral Sciences
Faculty of Dentistry

14 December 2012

Dear Professor Thomson,

I am writing to let you know that, at its recent meeting, the Ethics Committee considered your proposal entitled “Personality characteristics and self-reported oral health”.

As a result of that consideration, the current status of your proposal is: - Approved

For your future reference, the Ethics Committee’s reference code for this project is: - 12/341.

The comments and views expressed by the Ethics Committee concerning your proposal are as follows:

While approving the application, the Committee would be grateful if you would respond to the following:

The Committee would be grateful if you could provide us with a copy of the letter of introduction that will be sent to participants for our records.

The Committee suggests that including an indicated time commitment in the Information Sheet would be helpful for participants.

Please provide the Committee with copies of the updated documents, if changes have been necessary.

Approval is for up to three years from the date of this letter. If this project has not been completed within three years from the date of this letter, re-approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.
Yours sincerely,

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8256
Email: gary.witte@otago.ac.nz

c.c. Professor R D Cannon  Head  Department of Oral Sciences
Appendix D: Introductory sheet

Dear Participant,

My name is Hadeel Ibrahim. I am a postgraduate student at the School of Dentistry, University of Otago. I am undertaking the research project “Personality characteristics and self-reported oral health”. This project involves a survey that aims to answer important questions about how different people think about their oral health. The study is being supervised by Professor Murray Thomson and Dr Lyndie Foster Page.

You have been randomly selected from the South Dunedin Electoral Roll to take part in the study. Your participation in this survey is entirely optional. You can choose to refuse participation in the current study without consequences. There is no cost to participate in the study.

If you choose to take part, please complete the enclosed questionnaire and return it to me in the FREEPOST envelope provided. This survey will take 10-15 minutes to complete. I would appreciate your sending it back to me by 28 March 2013.

As a thank you for taking part in the study, you will be entered into two draws for a $200 supermarket voucher. We will notify the winners once the survey is over.

Finally, I wish to thank you for your time.

Yours sincerely,

Hadeel Ibrahim
Appendix E: Information sheet for participants

"Personality characteristics and self-reported oral health” study

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you, and we thank you for considering our request.

What is the Aim of the Project?

The aim of this research is to explore how certain personality characteristics modify the way people view their oral health. The information will be obtained from the questionnaire, and used by us to provide a better understanding of some of the factors that may influence how people report their oral health. This project is being undertaken as a supervised Doctoral student project (for the Doctorate of Clinical Dentistry in Prosthodontics).

What Type of Participants are being sought?

The participants were randomly selected from the Electoral Roll to take part. People taking part should be able to read and answer the provided questionnaire, and be in the target age range for the study, which is 35-54 years.

What will Participants be Asked to Do?

Should you agree to take part in this project, you will be asked to answer all of the questions provided in the questionnaire. You are provided with a self-addressed FREEPOST envelope to send us the questionnaire back. Please send it back to us before 30 March 2013, and that taking part in the project is completely optional.

Please be aware that you can decide not to take part in the project without any disadvantage to yourself of any kind.

What Data or Information will be Collected and What Use will be Made of it?

Data will be collected as mentioned above. Statistical tests will be used to analyse the data to explore the relationships between different study parameters. Personal information (such as denture wear, number of remaining teeth, smoking status, etc.) will be collected to explore the effect of these on oral health. This information will be accessible only by the researchers.

For the final thesis report and any scientific journal publication, every attempt will be made to preserve your anonymity. The data will be accessible only to the researcher and her supervisors. The data collected will be securely stored in a way that only those mentioned will be able to gain access to it. Data obtained as a result of the research will be retained for at least 5 years in secure storage. Any personal information held on the participants [such as contact details] may be destroyed at the completion of the research even though the data
derived from the research will, in most cases, be kept for much longer or possibly indefinitely. The findings of the project may be published and will be available in the University of Otago library (Dunedin, New Zealand), but every attempt will be made to preserve your anonymity. There will be no commercial use of the data.

**Can Participants Change their Mind and Withdraw from the Project?**

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

**What if Participants have any Questions?**

If you have any questions about our project, either now or in the future, please feel free to contact either:

- Hadeel Ibrahim
  - School of Dentistry
  - University of Otago
  - Telephone Number: 479 7093
  - Email: hadeeli@hotmail.com

or

- Murray Thomson
  - School of Dentistry
  - University of Otago
  - Telephone Number: 479 7116
  - Email: murray.thomson@otago.ac.nz

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research, you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479 8256). Any issues you raise will be treated in confidence and investigated, and you will be informed of the outcome.
Appendix F: The study questionnaire

Questionnaire on personality characteristics and self-reported oral health

Thank you for taking part in this study. You can still participate in the study even if you do not have any of your own teeth remaining - we are still very interested in your answers. Please answer all the questions. When you have finished, please place the completed questionnaire in the FREEPOST envelope and post it straight back to us. Remember: no stamp is required, and your returned questionnaire will go into two draws to win $200 prizes.

The first section of this questionnaire will ask you about some background information. Next there is a section that includes a number of questions about your general dental health, followed by a few questions about the effect of dental problems on your daily life. We then ask about how you feel when visiting the dentist, followed by a few questions about dry mouth. Finally, the questionnaire asks you about how you have been feeling in general during the last year.

Principal Investigator: Hadeel Ibrahim (Postgraduate student)
Department of Oral Rehabilitation
The University of Otago

Under the supervision of: Professor Murray Thomson
Department of Oral Sciences
The University of Otago

For information from the researchers about any part of this study, please phone Hadeel Ibrahim on
(03) 479-7093.
First, we would like to ask a few questions about you (background information):

How old are you? ________ years

What is your gender? (please circle the answer which applies)

Male         Female

What ethnic group(s) do you identify with? (please circle all which apply)

European       Māori       Pacific Islander       Asian

other (please specify) ____________________________________________

Do you have a Community Services Card? (please circle the one that applies)

Yes         No

What is your occupation (or prior occupation if retired)? (please write in the space below)

______________________________________________________________

What is the highest level of education you attained? (please circle the one that applies)

Primary school       Secondary school       Trades qualification

Tertiary

The next few general questions are about your dental health:

Do you still have any of your own teeth remaining? ______

Do you expect that your teeth will last for life? (please circle the answer which applies)

Yes         No         Don’t know

Do you wear a denture? (please circle the answer which applies)

Yes         No

If yes was the answer to the previous question, what type of denture are you wearing? (please circle the one which applies)

Full denture       Partial denture
If you are not currently wearing a denture, do you expect that you will need to do so at any stage in your life? (please circle the answer which applies)

Yes          No          Don’t know

What is your usual reason for visiting the dentist? (please circle the one which applies)

Check-up     Problem     Never go     Don’t know

When was the last time you visited the dentist? (please circle the one which applies)

Less than 1 year           Between 1 and 2 years   Between 2 and 5 years   More than 5 years   Never been   Can’t remember

What was the reason for that last dental visit? (please circle the answer which applies)

Check-up     Pain         Broken filling/tooth  Gum problems

Denture problems

other (please specify)

How often do you brush your teeth? ________________________________

Do you use a mouthwash? (please circle the answer which applies)

Yes          No

Do you smoke? (please circle the answer which applies)

Yes          Never smoked     Previous smoker

How would you describe the health of your teeth or mouth? (please circle the one which applies)

Excellent    Very good    Good    Fair    Poor

All things considered, would you say that, over the past year, the health of your mouth has: (please circle the one which applies)

Improved     Stayed the same    Got worse

How often does your mouth feel dry? (please circle the one which applies)

Never          Occasionally     Frequently     Always
The next set of questions are about how oral problems can affect your life.

For each of the following questions, please circle the answer which best applies to you during the last year. Because of trouble with your teeth, mouth or dentures:

<table>
<thead>
<tr>
<th>Question</th>
<th>Never</th>
<th>Hardly ever</th>
<th>Occasionally</th>
<th>Fairly Often</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you had trouble pronouncing any words?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you felt that your sense of taste has worsened?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you had painful aching in your mouth?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you found it uncomfortable to eat any foods?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you been self-conscious?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you felt tense?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has your diet been unsatisfactory?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you had to interrupt meals?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you found it difficult to relax?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you been a bit embarrassed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you been a bit irritable with other people?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you had difficulty doing your usual jobs?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you felt that life in general was less satisfying?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you been totally unable to function?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This next section asks about how you feel when you go to the dentist. It includes two sets of questions.

The first set comprises four questions. Please tick the box of the answer which comes closest to how you feel.

If you had to go to the dentist tomorrow, how would you feel about it?
- I would look forward to it as a reasonably enjoyable experience
- I wouldn’t care one way or the other
- I would be a little uneasy about it
- I would be afraid that it would be unpleasant and painful
- I would be very frightened of what the dentist might do

When you are waiting in the dentist’s surgery for your turn in the chair, how do you feel?
- Relaxed
- A little uneasy
- Tense
- Anxious
- So anxious that I sometimes break out in a sweat or almost feel physically sick

When you are waiting in the dentist’s chair while he gets his drill ready to begin working on your teeth, how do you feel?
- Relaxed
- A little uneasy
- Tense
- Anxious
- So anxious that I sometimes break out in a sweat or almost feel physically sick

You are waiting in the dentist’s chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments which he will use to scrape your teeth around the gums, how do you feel?
- Relaxed
- A little uneasy
- Tense
- Anxious
- So anxious that I sometimes break out in a sweat or almost feel physically sick
The second set of questions ask more about how you feel about visiting the dentist. Please tick the box that indicates how much you agree with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Agree a little</th>
<th>Somewhat agree</th>
<th>Moderately agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel anxious shortly before going to the dentist.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I generally avoid going to the dentist because I find the experience unpleasant or distressing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I get nervous or edgy about upcoming dental visits.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think that something really bad would happen tomorrow if I were to visit a dentist.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel afraid or fearful when visiting the dentist.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My heart beats faster when I go to the dentist.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I delay making appointments to go to the dentist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I often think about all the things that might go wrong prior to going to the dentist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The next section asks about your experiences of mouth dryness during the last 4 weeks. For each statement, please tick the box for the response which best applies to you.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Occasionally</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>My mouth feels dry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have difficulty in eating dry foods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My mouth feels dry when eating a meal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have difficulties swallowing certain foods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My lips feel dry</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This last set of questions ask about how you generally felt during the last year (please circle the response which applies).

In the past year, to what extent have you felt:

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Very slightly or not at all</th>
<th>A little</th>
<th>Moderately</th>
<th>Quite a bit</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interested</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distressed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excited</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upset</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guilty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scared</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hostile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enthusiastic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proud</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irritable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alert</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashamed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspired</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nervous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determined</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attentive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jittery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afraid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thank you for filling in the questionnaire. Please put it in the FREEPOST envelope and post it back to us. Remember: you don’t need to put a stamp on it.
Appendix G: Individual responses to the dental anxiety scales (IDAF-4C and DAS)

Individual responses to the, DAS and the IDAF-4C are presented in Tables D.1 and D.2, respectively.

**Tables G.1** Individual responses to DAS question

**Table G.1.1** (If you had to go to the dentist tomorrow, how would you feel about it?)

<table>
<thead>
<tr>
<th>Response option</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would look forward to it as a reasonably enjoyable experience</td>
<td>21</td>
<td>8.3</td>
</tr>
<tr>
<td>I wouldn’t care one way or the other</td>
<td>104</td>
<td>41.1</td>
</tr>
<tr>
<td>I would be a little uneasy about it</td>
<td>89</td>
<td>35.2</td>
</tr>
<tr>
<td>I would be afraid that it would be unpleasant and painful</td>
<td>34</td>
<td>13.4</td>
</tr>
<tr>
<td>I would be very frightened of what the dentist might do</td>
<td>5</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Table G.1.2** Individual responses to DAS question 2 (When you are waiting in the dentist’s surgery for your turn in the chair, how would you feel?)

<table>
<thead>
<tr>
<th>Response option</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would look forward to it as a reasonably enjoyable experience</td>
<td>93</td>
<td>36.8</td>
</tr>
<tr>
<td>I wouldn’t care one way or the other</td>
<td>103</td>
<td>40.7</td>
</tr>
<tr>
<td>I would be a little uneasy about it</td>
<td>32</td>
<td>12.6</td>
</tr>
<tr>
<td>I would be afraid that it would be unpleasant and painful</td>
<td>20</td>
<td>7.9</td>
</tr>
<tr>
<td>I would be very frightened of what the dentist might do</td>
<td>5</td>
<td>2.0</td>
</tr>
</tbody>
</table>
### Table G.1.3 Individual responses to DAS question 3 (You are waiting in the dentist’s chair while he gets his drill ready to begin working on your teeth, how do you feel?)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxed</td>
<td>45</td>
<td>17.8</td>
</tr>
<tr>
<td>A little uneasy</td>
<td>107</td>
<td>42.3</td>
</tr>
<tr>
<td>Tense</td>
<td>59</td>
<td>23.3</td>
</tr>
<tr>
<td>Anxious</td>
<td>32</td>
<td>12.6</td>
</tr>
<tr>
<td>So anxious that I sometimes break out in a sweat or almost feel physically sick</td>
<td>10</td>
<td>4.0</td>
</tr>
</tbody>
</table>

### Table G.1.4 Individual responses to DAS question 4 (You are waiting in the dentist’s chair to have your teeth cleaned. While you are waiting and the dentist is getting out the instruments which he will use to scrape your teeth around the gums, how do you feel?)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxed</td>
<td>70</td>
<td>27.7</td>
</tr>
<tr>
<td>A little uneasy</td>
<td>111</td>
<td>43.9</td>
</tr>
<tr>
<td>Tense</td>
<td>40</td>
<td>15.8</td>
</tr>
<tr>
<td>Anxious</td>
<td>25</td>
<td>9.9</td>
</tr>
<tr>
<td>So anxious that I sometimes break out in a sweat or almost feel physically sick</td>
<td>7</td>
<td>2.8</td>
</tr>
<tr>
<td>Item</td>
<td>Disagree</td>
<td>Disagree a little</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>I feel anxious shortly before going to the dentist.</td>
<td>71 (28.1)</td>
<td>75 (29.6)</td>
</tr>
<tr>
<td>I generally avoid going to the dentist because I find the experience unpleasant or distressing.</td>
<td>142 (56.1)</td>
<td>51 (20.2)</td>
</tr>
<tr>
<td>I get nervous or edgy about upcoming dental visits.</td>
<td>120 (47.4)</td>
<td>62 (24.5)</td>
</tr>
<tr>
<td>I think that something really bad would happen tomorrow if I were to visit a dentist.</td>
<td>206 (81.4)</td>
<td>24 (9.5)</td>
</tr>
<tr>
<td>I feel afraid or fearful when visiting the dentist.</td>
<td>159 (62.8)</td>
<td>51 (20.2)</td>
</tr>
<tr>
<td>My heart beats faster when I go to the dentist.</td>
<td>125 (49.4)</td>
<td>67 (26.5)</td>
</tr>
<tr>
<td>I delay making appointments to go to the dentist.</td>
<td>117 (69.2)</td>
<td>46 (18.2)</td>
</tr>
<tr>
<td>I often think about all the things that might go wrong prior to going to the dentist.</td>
<td>175 (69.2)</td>
<td>38 (15.0)</td>
</tr>
</tbody>
</table>