Outcomes of mandibular Kennedy Class I and II prosthetic rehabilitation

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KEYWORDS

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Denture replacement

Denture fit

Denture repair

Patient opinion

Mandibular distal extension dentures

ABSTRACT

Background: Loss of teeth has a negative impact on appearance, nutrition, function and diet. Rehabilitation of tooth loss is an important function of oral health care. Rehabilitation with removable prosthesis of mandibular terminal edentulous areas has been associated with more negative outcomes than of tooth-bounded regions.

Aim: To describe outcomes of dental prosthetic rehabilitation with mandibular distal extension dentures 5-6 years after insertion. The outcomes investigated are **frequency of use, repair, replacement and fit** of the denture prosthesis; the occurrence of abutment **tooth loss** as an indicator of oral health status and **patient opinion** concerning prosthetic rehabilitation.

Methods: Technician records were used to select patient records of individuals fitted with mandibular distal extension dentures in January 2011-June 2012 by the University of the Western Cape Faculty of Dentistry at Tygerberg Oral Health Centre. Information pertaining to the prosthesis, oral health status and patient opinions was recorded from 152 files and augmented by telephonic interviewing 30 randomly selected patients from the initial sample.

Results: The outcomes observed were a low frequency of use and high patient dissatisfaction with treatment. Remakes 17% (n=26), repairs 6% (n=9) and abutment tooth extractions 8% (n=12) were the most commonly observed outcomes. Large portion (69% n=105) of the sample received no follow-up treatment once the denture was inserted. There were no statistically significant association between these outcomes and the variables measured like age, gender, opposing dentition, number of recalls and denture base material used.

Conclusion: The most common oral health outcome was abutment tooth loss; as were the prosthetic outcomes of remakes and repairs. Patients were generally dissatisfied by prosthetic treatment.

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DECLARATION

I hereby declare that the study: "*Outcomes of mandibular Kennedy Class I and II prosthetic rehabilitation*" is my own work, that has not been submitted before for any degree or examination in any university, and that all sources I have used or quoted have been indicated and acknowledged by complete references.

Signed: …….

Joanna Yeukai Chamoko May 2018

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DEDICATION

I would like to dedicate this work to friends, family, colleagues and fleeting acquaintances who in some way have helped shape the person I am today.

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ABBREVIATIONS

CDs-Complete dentures

ODs-Overdentures

FPDPs-Fixed Partial Denture Prostheses

RPDPs-Removable Partial Denture Prostheses

KCI- Kennedy Class I

KCII-Kennedy Class II

ICK-Implant-Corrected Kennedy Classification

TMJDs-Temporo-Mandibular Joint Disorders

PI-Plaque Index

GI-Gingival Index

RPI-mesial Rest-Proximal plate-I-bar

SDA-Shortened Dental Arch

CHAPTER 1

INTRODUCTION

Preshaw and colleagues (2011) quoting the International Dental Federation (FDI), reported that 30% of adults older than 65 in the world have lost all their teeth. In the same study (Preshaw *et al.*, 2011) they state that according to Adult Dental Health Survey (2009) reported that 37% of the population in England and Wales was edentulous in 1968 and only 6% in 2009. This decrease has had different implications for different populations.

Due to an increase in the American elderly population the demand of prosthetic rehabilitation has not fallen though the occurrence of complete edentulism has (Douglass *et al.*, 1988). In contrast to this, European countries have observed both a decline in complete edentulism and the demand for complete removable prostheses though the population of the elderly has increased (Mojon *et al.*, 2004). As more people retain their teeth into old age the prevalence of partial edentulism has increased. In 2002, in the United States (US), a quarter of a million people under the age of 40 were reported to have removable partial dentures (Jorge *et al.*, 2012).

The South Africa Demographic and Health Survey (SADHS 2003) reported that 23% of adults aged between 35-44 years were completely edentulous. In contrast to this, an earlier survey (Douglass *et al.*, 1988) showed that 12.6% of the adult population aged between 35-44 years was completely edentulous. This indicates an increasing incidence in tooth loss among South African adults. Rehabilitation of tooth loss in the South African population as function of oral

care is therefore important (Douglass *et al.*, 1988). Tooth loss due to caries, periodontal diseases and trauma is sometimes unavoidable (Preshaw *et al.*, 2011). From the clinician's point of view, prosthetic rehabilitation aims to improve distribution of occlusal forces on remaining teeth, maintain the stability of the dentition and increase masticatory performance (Budtz-Jorgensen *et al.*, 1985). In contrast, patient perception of prosthetic rehabilitation is centred on the improvement of aesthetics and mastication with minimal discomfort and disruption to oral functions (Preshaw *et al.*, 2011). Therefore, ensuring successful outcomes and long-term survival of prostheses minimises costs particularly when placed in younger patients (Lekholm *et al.*, 1986).

The purpose of this study is to determine the outcome of rehabilitating distal edentulous spaces of the mandible with RPDPs while bearing in mind importance of success as highlighted above. The outcomes are going to be assessed quantitatively (frequency of denture use, repair and replacement and number of lost abutments) and qualitatively (patient opinions on treatment).

CHAPTER 2

LITERATURE REVIEW

2.1. Partial edentulism

The absence of some but not all teeth is termed partial edentulism (Al-Johany & Andres, 2008). Oral rehabilitation in partial edentulism is to correct problems such as impaired mastication, aesthetics and speech and the decline of patient assessed quality of life that arise due to tooth loss. The major determining factor for treatment is the location of the lost tooth or teeth and if the missing teeth require replacement. Table 1 indicates the prevalence of partial edentulism as determined by various researchers in different studies and populations. Here, partial edentulism is shown to be more common in the mandible than the maxilla (Jeyapalan & Krishnan, 2015).

Table 1: Prevalence of partial edentulism in different jaws (Jeyapalan & Krishnan, 2015)

Author	Maxilla	Mandible
Curtis *et al.*, (1992)	37%	63%
Keyf *et al.*, (2001)	44%	56%
Prabhu *et al.*, (2009)	41%	59%
Sadiq *et al.*, (2012)	49%	51%
Naveed *et al.*, (2011)	32.6%	36.8%
Khalil *et al.*, (2013)	43.6%	56.4%
Patel *et al.*, (2014)	63.2%	50.36%
Abdel Rahman *et al.*, (2013)	49.63%	67.4%

2.2. Classification systems of partially edentulous ridges

Edentulous spaces in the mouth are classified for the purposes of ease of communication among dental professionals and for teaching purposes (Al-Johany & Andres, 2008). The ideal classification system should be simple, universally accepted, and aids visualisation of edentulous area as well as treatment and prosthetic design. The ideal system should also describes the nature of edentulous spaces, state of remaining teeth, antagonist teeth and edentulous ridges (Bratu *et al.*, 2007). Many classification systems have been proposed but the most commonly used is the one proposed by Dr Edward Kennedy in 1925 (Al-Johany & Andres, 2008). This is denoted as follows:

Kennedy Class I: Bilateral edentulous areas located posterior to remaining natural teeth

Kennedy Class II: Unilateral edentulous area located posterior to remaining natural teeth

Kennedy Class III: Unilateral edentulous area with natural teeth remaining both anterior and posterior to it

Kennedy Class IV: A single edentulous area crossing the midline and located anterior to natural teeth

Applegate in 1954 proposed rules to govern the application of the Kennedy classification. The modified classification system was then termed Applegate-Kennedy classification system for edentulous ridges (Al-Johany & Andres, 2008; Carr & Brown 2011). These revisions were as follows:

1. The classification is determined only by teeth that are to be replaced by the prosthesis,
2. The classification designates edentulous spaces after extraction of compromised teeth not before,

3. The most posterior edentulous space designates the classification,
4. The edentulous areas other than the one determining the classification are termed modifications and
5. Roman numerals designate the class while Arabic numerals denote the modifications.

This study used the Kennedy classification system though it does not describe the extent of edentulous space, the nature of the supporting tissues, the condition of remaining teeth, the state of the antagonist jaw and the position of implants.

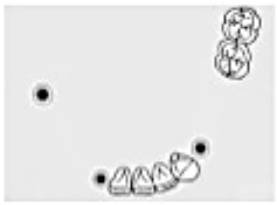
The implant-corrected Kennedy (ICK) classification modifies the Kennedy classification to describe implant position. The implant position denotes an implant already in situ or a proposed site of placement. The following rules govern the ICK classification (Al-Johany & Andres, 2008):

1. Edentulous spaces that are restored with implant fixed prosthesis are not included in the classification,
2. The classification is used to describe edentulous space restored with implant RPDPs,
3. The phrase implant-corrected Kennedy classification or ICK is used to describe a class e.g. Kennedy class I becomes implant-corrected class I (ICK I),
4. Roman numeral denote the class and Arabic numerals denote the modifications,
5. Abbreviation “max” denotes maxilla, “man” is mandible and “mod” is modification,
6. The International Dental Federation (FDI) or the American Dental Association (ADA) notation for tooth position is used to describe the position of the implant and
7. When denoting the system, the main classification is indicated first, followed by number of modifications and then the location of the implants with the # sign.

An example is ICK I mod 2 #36#46: this means that the main class is a Kennedy class I, with two modifications and two implants in the position of 36 and 46 according to the FDI notation. The diagram below illustrates examples of situations the ICK classification is used. The position of the implants is indicated using the American Dental Association (ADA) notation (Al-Johany & Andres, 2008).

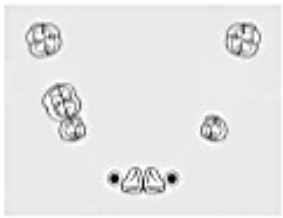
Figure 1: Illustrating the Implant-corrected Kennedy Classification system (ICK) (Al-Johany & Andres, 2008)

ICK I (#2, 15).



ICK II mod 1 (#21, 26, 30).

ICK I (#2).



ICK III mod 3 (#23, 26).

2.3. Prevalence and incidence of tooth loss

The number of teeth retained into old age has been used as a measure oral health. The pattern of tooth loss varies in different populations (Vadavadagi *et al.,* 2015). Various studies have attempted to investigate the link between tooth loss and different socio-economic factors (Prabhu *et al.,* 2009; Vadavadagi *et al.,* 2015; Jeyapalan & Krishnan, 2015). In India, they found that complete edentulism was more prevalent in rural communities whilst partial edentulism was more common in urban areas. The authors attributed this to a disparity in the provision of oral health care between rural and urban areas (Vadavadagi *et al.,* 2015). According to Prabhu and colleagues, the World Health Organisation (WHO) guidelines indicate that the highest prevalence of partial edentulism occurs between the ages 35-44 years. In an investigation of this age group in urban India, Prabhu and colleagues (2009) found that:

1. Kennedy Class III scenarios was the most common,
2. Mandibular partial edentulism was more common than maxillary,
3. No correlation between partial edentulism and gender was present,
4. There was reduced occurrence of partial edentulism when individuals had higher levels of education and income,
5. Socio-economic parameters like education, occupation, income and motivation influence tooth replacement,
6. Individuals with poor oral hygiene, low family income, low literacy and/or lack of motivation to care for their teeth were more likely to lose teeth and
7. Age correlates positively with tooth loss. With increase in age, an increase in the occurrence of Kennedy Class I and II was observed.

Younger adults tend to present with Kennedy Class III and IV partial edentulism. This is attributed to loss of early loss of first molars as these teeth erupt first, and loss of anterior teeth

due to the susceptibility of children to trauma of these teeth (Jeyapalan & Krishnan, 2015). As individuals get older and lose more teeth the Kennedy Class III extends into a class I and II. Class I and II partial edentulism is more common in the mandible while class III and IV are more common in the maxilla. Removable partial denture prosthesis (RPDPs) placement is more common with Kennedy Class I and II while rehabilitation of class III and IV is usually with fixed partial denture prosthesis (FPDPs) and implants (Jeyapalan & Krishnan, 2015). Table 2 illustrates the different incidence rate of partial edentulous ridges based on the Kennedy classification:

Table 2: Distribution of Kennedy Classification as reported in various studies (Jeyapalan & Krishnan 2015)

Author	Location	Sample size	Class I	Class II	Class III	Class IV
Curtis *et al.*, (1992)		327 RPDs	40%	33%	18%	9%
Keyf *et al.*, (2001)	Turkey	362 patients; 528 RPDs	43%	38%	18%	0%
Sadiq *et al.*, (2002)	Saudi Arabia	650 Patients; 740 RPDs	25%	28%	41%	6%
Zaigham *et al.*, (2004)	Pakistan	367 Patients	12.5%	26.5%	57.5%	3.5%
Bharathi *et al.*, (2004)		112 Patient records	18%	11%	62%	9%
Prabhu *et al.*, (2009)	India	350 patients	12%	15%	72%	1%
Ehikhamenor *et al.*, (2010)	Benin	351 Patients	3%	2%	63%	26%
Naveed *et al.*, (2011)	Pakistan	1000 patients	19%	18%	57%	5%
Abdel-Rahman *et al.*, (2013)		963 cases	25.75%	22.84%	48.84%	1.55%
D'Souza *et al.*, (2014)	India	423 Patients	19.27%	23.94%	50.3%	6.49%

2.4. Rehabilitation of partial edentulism

Prosthetic rehabilitation of partially edentulous lower jaws involves the use of RPDPs, fixed partial denture prostheses (FPDPs), overdentures (ODs) or the use of implant-supported fixed or removable prostheses (Sunnegardh-Groneberg *et al.*, 2012). Rehabilitation of shortened or posteriorly reduced dental arches though, is not always necessary as sufficient masticatory function can be achieved with 20 teeth having 9-10 opposing pairs of teeth (Gotfredsen & Walls, 2007).

2.4.1. Examination, diagnosis and treatment planning for partial edentulism (Carr & Brown, 2011)

Six phases of removable partial denture provision are identified as follows:

1. Phase 1: Patient education
2. Phase 2: Diagnosis, treatment planning, design, treatment sequencing and mouth preparation,
3. Phase 3: Establishing support for distal extension bases,
4. Phase 4: Establishing accurate and verifiable occlusal relationships,
5. Phase 5: Delivery of removable denture prosthesis to patient,
6. Phase 6: Periodic recall and monitoring.

Phase 1: Patient education

Successful treatment with RPDPs is a shared responsibility between the patient and the clinician. Prior to the commencement of treatment, the patient must understand the benefits and the limitations of the prosthesis. This will help to ameliorate impossible expectations and

deter misuse of the prosthesis. In order to prevent the deterioration of oral structures as a consequence of wearing the RPDP, the patient is taught the importance of oral hygiene and attending maintenance visits. Patient education is an essential part of treatment planning and predicting a successful outcome.

Phase 2: Diagnosis, treatment planning, design, treatment sequencing and mouth preparation

Clinical and radiographic examination are important to establish a diagnosis. The oral tissues are evaluated to diagnose caries, defective restorations and active periodontal disease. The resilience of tissues to stress and treatment choice is determined accordingly. The occlusal plane, arch form and inter-arch relationships are evaluated clinically and using diagnostic casts. If following this, a removable partial appliance is selected as the choice of treatment, the casts are surveyed and the mouth is prepared for the prosthesis. Examination and diagnosis are principle to treatment selection as not all partially edentulous patient are suitable for RPDP rehabilitation.

Phase 3: Support for distal extension bases

This phase does not apply to the tooth-supported RPDPs as they are not supported by soft tissue. The anatomic ridge of distal extension edentulous areas does not represent the morphology of the tissue under occlusal loads. Normal impressions do not always denote accurate border extension or detail. Carr and Brown (2011), therefore recommend that the supporting soft tissue be recorded under an occlusal functional load. This provides adequate support and maintenance of support for the longest period.

Phase 4: Establish accurate and verifiable occlusal relationships

Clinicians insure that the framework rests fit into preparations without interfering with opposing occlusion. At this stage, adjustments are carried out to insure tooth arrangements are in occlusal harmony.

Phase 5: RPDP delivery to patient

The patient is given the prosthesis and any adjustments necessary are carried out. The clinician explains to the patient how to care for the prosthesis and remaining oral tissues as well as expectations during initial adjustment. They also explain the need for periodic monitoring and evaluation to detect early detrimental changes in the mouth.

Phase 6: Periodic recall and monitoring

During periodic recall visits the oral health status and condition of the prosthesis are monitored. Tooth restorations and cleaning as well as adjustments to the prosthesis are done as necessary. Clinicians are also able to evaluate acceptance of the appliance as well as adaptability. Commitment to oral hygiene is reinforced. Biannual periodic visits seem to be adequate for most patients.

Inadequate diagnosis, treatment selection, planning and sequencing, patient education and recall have been shown to adversely affect treatment outcome.

2.5. Indications for distal extension RPDPs

Prosthodontic treatment with RPDPs is preferably compared to use of fixed alternatives when prosthetic rehabilitation needs to be inexpensive and non-invasive (Dhingra, 2011). In contrast to this, fixed alternatives are associated with higher levels of technical and mechanical complications compared to the removable options (Budtz-Jörgensen, 1996). The indications of distal extension RPDPs increases with an increase in the number of missing teeth that are to be replaced (Wostmann *et al.*, 2005).

Wostmann and colleagues (2005) investigated the occurrence of evidence-based indications of RPDPs rehabilitation by reviewing research literature. They considered the effect of RPDPs on:

1. Masticatory function,
2. Nutritional status,
3. Quality of life,
4. Prophylactic benefits and
5. Effect on temporomandibular joint disorders (TMDs).

2.5.1. Masticatory function

Masticatory function declines with age due to the loss of teeth and the decline in masticatory muscle mass and density. Masticatory function, however, increases following prosthetic rehabilitation regardless of prosthesis design (Wostmann *et al.*, 2005; Xie *et al.*, 2014). Individuals with three or less occluding pairs benefit more from treatment with partial denture

prosthesis than those with more (Wostmann *et al.*, 2005). Those with more occluding pairs derive no functional benefit for restoring posterior distal edentulous spaces and find that the discomfort of the prosthesis outweighs the benefit (Wostmann *et al.*, 2005).

2.5.2. Nutritional status

Nutritional status also decreases with reduced masticatory function leading to unbalanced diet and malnutrition (Wostmann *et al.*, 2005; Xie *et al.*, 2014). The diet of individuals with less than 25 teeth consisted of foods high in cholesterol and saturated fats. These individuals consumed less vegetables and fibre (Xie *et al.*, 2014). An increase in masticatory function is seen with prosthetic rehabilitation though the patient's food selection was shown to remain unchanged (Wostmann *et al.*, 2005).

2.5.3. Quality of life

Wearers of distal extension dentures complain about lack of stability, lack of retention and unaesthetic clasps (Xie *et al.*, 2014). Satisfaction with removable denture increases when many occlusal units are added; otherwise the prosthesis is not worn (Preshaw *et al.*, 2011).

2.5.4. Prophylactic Benefits

Removable partial dentures are used to prophylactically stabilise occlusion and prevent drifting of teeth (Wostmann *et al.*, 2005).

2.5.5. Effect on temporomandibular joint disorders (TMJDs)

Removable prosthetic treatment does not prevent temporomandibular joint disorders but poorly constructed prostheses are associated with parafunctional jaw movements (Wostmann *et al.*, 2005).

2.6. Challenges associated with rehabilitating mandibular distal extensions

Clinicians are faced with challenges in providing adequate support, retention and stability when restoring the mandibular distal extension spaces using RPDPs. Most individuals will present with severely resorbed ridges due to disuse, migration and malpositioning of teeth, lost inter-arch space due to over-eruption and teeth that are unable to serve as abutments. These sequelae also occur with other classes of partial edentulism. The extent, though, is often magnified when posterior teeth are lost as distal partial edentulism is often long-standing (Applegate, 1960). Long-standing, because the loss of posterior teeth does not usually compromise aesthetics and reduction of function occurs after many teeth have been lost. Patients, therefore, only seek treatment when they have lost sufficient teeth to impair function and/or aesthetics (Applegate, 1960). The faster rate of mandibular alveolar bone resorption compared to that of the maxilla reduces the area available for support of distal extensions in mandible and increases the occlusal load of RPDPs on the ridge. This, compounded by the fact that, unlike the maxilla, there is no palate to render additional support, makes rehabilitation with distal extension dentures challenging (Vermeulen *et al.,* 1996).

The factors that influence the success of prosthetic rehabilitation of Kennedy Class I and II mandibular arches maybe categorised as follows (Ben-Ur *et al.,* 1999; Witter *et al.,* 1999; Wagner & Kern, 2000; Tanaka *et al.,* 2009; Preshaw *et al.,* 2011; Jorge et al., 2012; Dhingra, 2012):

1. Mechanical factors
2. Biological factors
3. Patient factors
4. Biomechanical factors

2.6.1. Mechanical Factors

The main mechanical failures are fractures of major and minor connectors (Budtz-Jörgensen, 1996). Free-end RPDPs are therefore subject to retreatment when framework fractures occur. With continued resorption of the distal end of the residual ridge the prosthesis requires rebasing, relines (if possible) and remakes (Witter *et al.*, 1999).

2.6.2. Biological Factors

Use of RPDPs is generally associated with an increased risk of caries and periodontal disease (Bergman *et al*., 1982). The retention of a RPDP through tooth and ridge coverage predisposes the teeth to plaque accumulation and bacterial overgrowth leading to caries and periodontal disease (Bergman *et al*., 1982). High levels of streptococcus mutans were observed in individuals who wore RPDPs and complete dentures (CDs) than those who did not. Patients with FPDPs had lower levels of candida albicans, lactobacilli and streptococcus mutans compared to those wearing RPDPs (Tanaka *et al.*, 2009).

Assessment of RPDP wearers 10 years after insertion without a system of recall showed high rates of tooth extractions due to periodontal compromise with only 36% of the group not showing oral hygiene related problems (Wagner & Kern, 2000). Contrary to this, another study (Chandler & Brudvik, 1984) reported no significant difference between the occurrence of caries and periodontal disease in patients with RPDPs and those without. Isidor and Budtz-Jorgensen (1990) in their study, where patient recall was done biannually for the first 2 years then annually for 3 years, recorded high plaque scores and gingivitis but there were no significant changes in

probing depths. These findings are indicative of the influence of recall visits post-insertion, on the success of these prostheses. During recall visits, dental interventions such reinforcing oral hygiene instructions, fluoride applications, scaling and polishing, treatment of caries and periodontal disease, repairs and readjustments to the prosthesis are done (Bergman *et al.*, 1982)

2.6.3. Patient Factors

Patients who prefer fixed dental prosthetics cite better comfort and improved aesthetics as reasons for this preference (Dhingra, 2012). A dentist considering prosthetic rehabilitation may be limited by patients' poor oral hygiene, financial cost, chronic illness (like diabetes) and adverse social habits (like smoking) (Budtz-Jörgensen, 1996). Patients who consider the discomfort of a dental prosthesis to outweigh the perceived benefits will not wear it. Therefore, ensuring patient satisfaction is important in treatment planning and in defining success with prosthesis use (Preshaw *et al.*, 2011).

The morphology of residual ridge may also be unfavourable to provide support and stability such as in the case of a (Applegate, 1960; Owen, 2000):

a. knife edge ridge,
b. flat ridge,
c. tapered ridge or
d. ridges with flabby mucosa.

Malpositioned or periodontally compromised teeth may be ill-suited to provide retention and support for the prosthesis (Applegate, 1960; Owen, 2000).The dentist's own expertise to provide such treatment may also add to these limitations (Budtz-Jörgensen, 1996).

The success rate of an accurately constructed RPDP according to the literature is highly dependent on meticulous oral hygiene by the patient, follow-up treatment, readjustment of occlusion and re-emphasis on oral hygiene behaviour (Bergman *et al.,* 1982).

2.6.4. Biomechanical Factors

Restoration of Kennedy class I and II partially edentulous mandibles with RPDPs has historically posed biomechanical challenges because they derive support from two different tissues (Dhingra, 2012). A mandibular distal extension denture is supported by the periodontal ligament via the teeth through action of the rest seat and the mucosal tissues of the residual ridges. Variable degrees of displaceability occurs between these two tissues (Krol, 1973; Ben-Ur *et al.,* 1999; Owen, 2000; Dhingra, 2012).

The mucosal tissues undergo greater displaceability and slower recovery than the periodontal ligament when the prosthesis is displaced apically (Krol, 1973; Ben-Ur *et al.,* 1999; Dhingra, 2012). The portion of the denture supported by the mucosal tissue undergoes greater displacement when masticatory forces are applied to it than if it was tooth-supported. This results in the distal portion denture extension being displaced downwards and subsequent upward rotation around the most distal abutment tooth. The abutment tooth is therefore at risk from torqueing forces applied through the clasp (Krol, 1973; Ben-Ur *et al.,* 1999; Dhingra, 2012).

With continued resorption of the residual mandibular ridges the displaceability of the tissues becomes more pronounced. The adaptation of the denture fitting surface to the supporting tissues deteriorates. This necessitates the relining of dentures as they get older (Jorge *et al.*, 2012). These challenges are less pronounced in the case of maxillary distal extension dentures because of the additional support from palatal extension. In contrast, Kennedy Class III and IV RPDPs are tooth supported (similar to FPDPs) such that forces acting apically are directed through the teeth to the periodontal ligament and the alveolar bone via the clasp system (Krol, 1973; Ben-Ur *et al.*, 1999).

2.7. Techniques to overcome challenges of mandibular distal extension rehabilitation

In an effort to counteract these biomechanical challenges, certain measures have been developed as the distal extension denture evolved and these are (Krol, 1973; Kayser, 1981; Eliason, 1983; Ben-Ur *et al.*, 1999; Feit, 1999; Witter *et al.*, 1999; Armellini & von Fraunhofer 2004; Niarchou *et al.*, 2011):

a) Impression techniques
b) RPDP design
c) Shortened dental arch (SDA)
d) Use of precision-attachments
e) Incorporation of implants

2.7.1 Impression techniques

The impression must accurately record the denture bearing mucosa and be adequately extended over the retro-molar pad, lingual fossa and buccal vestibule as this influences load distribution. The aim of an accurate impression is to minimise movement of the denture base and the stresses on abutment teeth by optimising load distribution through a well-fitting denture base. The altered cast technique was therefore developed with this in mind (Feit, 1999).

Altered cast technique

The altered cast technique takes into to account the differences in the resilience of teeth and the mucosa of the residual ridge. It minimises movement of the denture base, provides a favourable ridge-denture base relationship and allows occlusal load to be distributed evenly. Uniform distribution of the load minimises atrophy of the residual ridge (Feit, 1999).

Inaccurately taken impression result in uneven stress distribution which counteracts the purpose of this technique. Use of the technique increases treatment visits but has been shown to limit post-operative visits, improve load distribution, minimise the atrophy of the ridge, eliminate food traps and reduce the torqueing of abutment teeth (Feit, 1999).

2.7.2 RPDP design

The objective of partial denture design is to fabricate a prosthesis that contributes to the normal functioning of the mouth by improving mastication, speech and appearance while preserving the remaining teeth. There is no evidence in the literature or consensus amongst professional concerning which design is superior to another. What is agreed upon, however, is that the design should incorporate the biomechanical aspects of support, retention and stability. An ideal design minimises plaque accumulation by limiting the coverage of teeth with the framework, avoiding contact with the free gingival margin and limiting number of denture components (Niarchou *et al.,* 2011). Certain principles were shown to positively influence denture design such as the use of rigid major connector, multiple positive rest seats with mesial placement thereof, use of parallel guide planes and the I-bar clasp design (Feit, 1999).

A clasp serves to actively retain the prosthesis by engaging the undercut, thus resisting dislodgement forces when withdrawing the denture. The action of a clasp should be reciprocated by an equal and opposite force to prevent the clasp from acting like an orthodontic appliance. Occlusally approaching clasps minimise gingival trauma but are unaesthetic in the anterior regions. For optimum strength and thickness, the length of a cast clasp must be 15mm or greater. To achieve this length around canines or premolars inclusion of a gingivally approaching clasp is appropriate. Lastly, a clasp must be at rest until it is activated by a dislodging force (Krol, 1973).

The lingual bar is preferable in mandibular denture designs because it minimises tooth coverage by its use is limited by the depth of the sulcus, presence of tori, periodontally compromised teeth and previous negative experience with it. The incorporation of indirect retainers in Kennedy Class I and II designs minimises the movement of the denture base (Niarchou *et al.,* 2011).

The placement of rests mesial of the distal extension changes the forces acting around the abutment from a class 1 leverage to a more favourable class 2. Four different clasp assembly systems that incorporate this torque releasing effect and mesial placement of a rest have been described in literature (Ben-Ur *et al.,* 1999):

a. Mesial Rest-Proximal plate-I-bar (RPI)
b. Mesial Rest-Proximal plate-Akers clasp (RPA)
c. Mesial Rest-Proximal plate-L-bar (RPL)
d. Equipoise, back action type clasp

These clasps system allow displacement of the denture base downwards without torqueing the abutment tooth by releasing stress, allowing the axis of rotation to pass through the mesial rest and creating a class II lever effect (Ben-Ur *et al.*, 1999).

a. Rest-Proximal plate- I bar Concept (RPI)

This denotes a design concept incorporating a mesially-placed rest seat with an I-bar clasp and a proximal plate. When rotation occurs in the area of the rest, the I-bar and the proximal plate disengages from the tooth and the abutment tooth is braced by the one mesial to it (Niarchou *et al.*, 2011).

Advantages of the RPI concept (Krol, 1973; Eliason, 1983)

1. The disengaging of the proximal plate and I-bar limits torqueing forces transmitted to the abutment tooth,
2. I-bar is aesthetic in certain situations as its contact with the tooth is minimal and
3. Minimal coverage of the tooth limits plaque accumulation and subsequent caries.

Disadvantages (Eliason, 1983)

1. Insufficient vestibular depth will not allow 3mm clearance of the if I-bar from gingival margin,
2. When a large undercut exists below the clasp, relief of the approaching arm of clasp may irritate the cheek,
3. Clasp must be thick and rigid to avoid deformation and

4. Some patients find it difficult to manipulate as there is no place to unhook the clasp when removing the denture.

The Rest-Proximal plate-Akers clasp (RPA) concept is suggested as an alternative to overcome these short comings (Ben-Ur *et al.,* 1999).

2.7.3 Shortened Dental Arch (SDA)

The traditional concepts of prosthetic rehabilitation emphasised the importance of posterior molar support and the need to restore all patients to a full arch compliment of teeth (Witter *et al.,* 1999). However, the shortened dental arch (SDA) concept states that a dental arch with an intact anterior and premolar region meet the requirements of a functional dentition (Kayser, 1981; Witter *et al.,* 1999; Armellini & von Fraunhofer, 2004). In 1992, the World Health Organisation (WHO), recognised that "the retention, throughout life, of a functional, aesthetic, natural dentition of not less than 20 teeth and no recourse to prostheses should be a treatment goal for oral health" (WHO, 1992).

Though masticatory ability has been shown to decline slowly with the progressive loss molar teeth, patients show sufficient adaptive capability to the decline until 4 occluding pairs of teeth remain. A rapid decline in masticatory ability is shown to occur if more posterior occluding pairs are lost from this point. Therefore individuals are able to function sufficiently with 20 teeth consisting of an intact anterior region and 4 symmetrically distributed posterior occluding pairs (Armellini & von Fraunhofer, 2004)

The reduction in masticatory function, food choices, food perception and consumption in patients with a SDA was acceptable to patients. The comparison of individuals wearing RPDPs and those with SDA indicated no significant difference in oral function. In a Tanzanian study, 95-98% of individuals with 0-2 pairs of occluding premolars had difficulties with chewing while in contrast only 3-5% of those with 4 premolar occluding pairs had similar challenges. Unevenly distributed teeth and asymmetrical SDA patients have challenges with mastication. More joints noises were observed in patients with asymmetrical SDA and no posterior support than those with complete arches and symmetrical SDAs. Occlusal stability is not significantly impaired in SDAs with little distal migration noted (Armellini & von Fraunhofer, 2004).

According to Armellini and von Fraunhofer (2004), the decision to restore SDAs with RPDPs may be specified by individual patient cases and the dentist's perception. Some patients fail to adapt to the use of distal extension RPDPs and do not accept the prostheses based on comfort, function and aesthetics. Comparison of oral comfort of individuals with SDAs, those with SDAs and RPDPs and completely dentate individuals noted that no significant differences pertaining to pain and discomfort. Eight percent of the patients with SDA had compromised masticatory function while 20% of those with SDAs and RPDPs were intolerant to the RPDPs and stopped wearing them. Though objective masticatory function may be improved by supplying patients with SDAs with RPDPs, the subjective perception of the patient's function may not be improved. Iatrogenic damage to remaining teeth may be introduced especially in patients with systemic disease (e.g. diabetics, patients on chemotherapy and/or radiotherapy) with RPDP placement (Armellini & von Fraunhofer, 2004). The general perception among clinician is that SDA is an acceptable treatment option (Khan *et al.*, 2012; Armellini & von Fraunhofer, 2004).

2.7.4 Precision attachments

A precision attachment is a mechanical device used to fix, retain and stabilise a prostheses. It is a direct retainer used in place of a clasp (Burns & Ward, 1990a). It consists of a matrix or receptacle into which a patrix fits into. The matrix is usually within the crown of an abutment tooth while the patrix extends from the framework of the RPDP. The use of precision attachments does not eliminate the need for even distribution of occlusal load to denture bearing mucosa and abutment teeth. It is essential that the design principles of the framework be followed to ensure accurate relationship of the denture base and supporting tissues. The framework must therefore be rigid and make contact with 3 or more teeth via prepared rest seats. The framework should make contact with other teeth not be retained via the precision attachments only (Burns &Ward 1990a).

Precision attachments retain the prostheses through the following mechanisms (Rani *et al.*, 2016):

i. Friction: this is achieved by close-fitting parallel wall moving past each other. The amount of frictional forces increases as the surfaces area and length of parallel walls increases,
ii. Binding: a receptor site will bind the parallel walls of an object when it tips within the receptor,
iii. Wedging: friction resists separation in the terminal position of separation,
iv. Internal spring loading: an internal spring clip increases frictional loading and
v. Active retention: to withdraw the patrix from the matrix it must undergo elastic deformation or change in shape before it can be unseated from its rest position

Precision attachments are used as movable links between crowns and bridges and RPDPs. They are also useful as stress breakers around distal abutments in distal extension RPDPs. For sectional dentures or where a denture has modifications, the precision attachment can act as a connector (Angadi *et al.*, 2012).

Debilitated or patients with reduced cognitive ability do not possess the manual ability to manipulate a prosthesis with precision-attachments as it has one path of extraction. These individuals would not benefit from a precision-attachment prosthesis. Precision-attachments are also contraindicated, for the same reason, in patients with neuromuscular conditions. Periodontally compromised patients and patients with a high cariogenicity should not be treated with precision-attachment RPDPs. The morphology of the abutment teeth may not allow a precision-attachment to be used if there is limited space (Angadi *et al.*, 2012).

Precision-attachment RPDPs are less traumatic to abutment teeth when compared to clasps and they allow forces to be directed through the long axis of the abutment tooth when they are placed intracoronally. Patients report better satisfaction with precision-attachments than with clasps. Extensive preparation of teeth is necessary before precision-attachments may be used. The close proximity of the attachment to the gingiva promotes irritation and plaque accumulation. They are also subject to wear and with time there is loss of retention. This mobility has adverse effects on the abutment teeth. Precision-attachment are more costly than conventional RPDPs retained by clasps (Rani *et al.*, 2016).

2.7.5 Implants

Placement of a distal implant limits the displacement of the distal extension base and reduces torqueing around distal abutments. The distal implant with a healing abutment or a resilient attachment provides support and stabilisation (Zancope *et al.,* 2015). Implants improve occlusal force distribution and minimise transmission of harmful non-axial forces through abutment teeth (Brudvik, 2003). An increase in patient satisfaction with the prostheses was observed when a distal implant was incorporated into the treatment with RPDPs. Subjective increase in masticatory ability were recorded with treatment with RPDPs and a distal implant. The recommended length of the implant is yet to be determined and researchers have achieved positive results with implant length varying between 6-13mm (Zancope *et al.*, 2015). The location of the implants must be planned with the possibility of a future fixed treatment option in mind. For support of the RPDPs, the implant must be in the most distal position, which is either in the location of the first molars or second molars. This position maximises stability. Placing the implant in the position of the third molar is contraindicated because this generated higher stresses around the abutment. The use of distal implants in conjunction with extension base RPDPs did not compromise implant survival or increase the marginal bone loss around the implants. This treatment protocol can be used as a cost effective alternative to implant-supported FPDPs (Zancope *et al.*, 2015).

Prosthetic complications described were pitting of the prosthesis surface in contact with the healing cap, implant abutment loosening and framework fractures. Inflammation around the implants is a common complication observed with this treatment (Zancope *et al.,* 2015).

2.8 Outcomes of mandibular distal extension dentures

The outcomes of oral rehabilitation with RPDPs can be evaluated in three broad categories (Bergman *et al.,* 1982; Chandler & Brudvik, 1984; Vermuelen *et al.,* 1996; Koyama *et al.,* 2010; Preshaw *et al.,* 2011 & Jorge *et al.,* 2012). These are:

- the impact of the prosthesis on the oral health status of the patient,
- factors pertaining to the prosthesis itself and
- patient opinions regarding treatment and function with the denture prosthesis.

2.8.1. Impact on oral health status

Bergman and colleagues (1982) investigated the caries and periodontal disease in wearers of RPDPS 10 years after treatment. They did this by measuring the baseline values of caries, gingival index (G.I.), plaque index (P.I.), pocket depths, tooth mobility and alveolar bone loss. These were also measured after ten years to determine the impact the denture prosthesis has on the tissues. The ultimate outcome of a negative change in these parameters is tooth restoration or loss. The findings of the research was that there were no evident changes to these clinical parameters after an individual has been wearing a removable prosthesis for 10 years (Bergman *et al.,* 1982). These findings were similar to those observed by Chandler and Brudvik in 1984 after clinical evaluation of patients wearing prosthesis for 8-9years. Both studies employed periodic recalls and treatment intervention when necessary. More abutments are extracted in wearers of free-end saddle dentures than the tooth-bounded (Jorge *et al.,* 2012). Most authors attribute this to unfavourable forces that forces transmitted through the abutment by the clasp when the distal extension is loaded (Ben-Ur *et al.,* 1999; Jorge *et al.,* 2012; Dhingra, 2012).

2.8.2. Outcomes pertaining to the prosthesis

The most significant failure of removable partial denture prosthesis is fractures of framework rather than deformation as noted by Jorge and colleagues in 2012. They evaluated prosthesis that were 5 years old. The outcomes of these failures were the remakes or repairs. The fit of the dentures was shown to decline as bone resorption continued over the 5 year period. This results in the need for relines or remakes (Jorge *et al*., 2012). Vermeulen and others (1996), used the number of relines, rebases and remakes to evaluate prosthetic failure in dentures 5 and 10 years old and noted that distal extension bases required more adjustments.

2.8.3. Patient opinions

A discrepancy exists between what clinicians view as the indications that prompt provision of RPDPs and what patients perceive as their needs. Dentists provide prosthesis to improve physical function, mitigate tooth wear and reduce loads on remaining teeth. Patients, on the other hand, look at their mouth as a whole and not the teeth only. If the prosthesis is an interference to speech, aesthetics, or comfort the functional aspects are of little to importance to them. Patients complain about the bulk of the dentures, changes in taste and feel of food, need of regular rinsing or use of denture fixatives. The motivation to wear a removable prosthesis increases when it improves the patient's appearance (Preshaw *et al,* 2012). A quantitative description of patient opinions is not sufficient and a qualitative aspect was included to fully describe patient thoughts and feelings (Creswell, 2003). Preshaw *et al.,* (2012) also showed that patient acceptance and satisfaction is poor when the prosthesis:

- replaces posterior teeth only,
- replaces a few posterior teeth and
- patient has 4 or more occluding pairs.

A summation based on the literature indicates that the outcomes of distal extension rehabilitation can be considered as follows (Bergman *et al.*, 1982; Chandler &Brudvik, 1984; Vermuelen *et al.*, 1996; Koyama *et al.*, 2010; Preshaw *et al.*, 2011 & Jorge *et al.*, 2012):

- impact on oral health status as determined by loss of abutment or number of restored teeth
- the status of the prosthesis as determined by relines, rebases, remakes and repairs and
- patient opinions concerning the treatment and denture prosthesis.

CHAPTER 3

AIMS AND OBJECTIVES

3.1. Aim

To assess outcomes of mandibular Kennedy class I and II prosthetic rehabilitation 5-6 years after insertion.

3.2.Objectives

1. To evaluate the status of the dental prosthesis 5-6 years after placement
2. To describe the oral health status of patients 5-6 years after receiving a prosthesis
3. To assess patient opinion of prosthetic treatment 5-6 years after placement

CHAPTER 4

METHODOLOGY

4.1. Study Design

A retrospective, observational study using both quantitative and qualitative data collection methods and analysis referred to as a mixed-methods approach.

4.2. Study population

Study sample included patients of any age and gender who were supplied with mandibular Kennedy Class I and II RPDPs from January 2011-June 2012 by the Faculty of Dentistry at the Tygerberg Hospital complex. The patients were selected from dental laboratory technician's records and patient records.

4.3. Sample size calculation

The sample size calculated was 100 by the number of patients fitted with posterior mandibular prostheses within the period stated above by the University of the Western Cape Faculty of Dentistry. A smaller sample of 30 patients (a subset of this initial sample) were telephonically interviewed using a questionnaire with open- and closed-ended questions.

4.4. Exclusion criteria

The following patients were excluded from the sample:

Fully edentulous patients

Patients with incomplete dental records

Prostheses rehabilitating Class III, IV and fully edentulous mandibles and maxillae

Rehabilitation of Kennedy class I and II using fixed partial denture prostheses (FPDPs), overdentures (ODs) or implant-retained prostheses

Patients with prostheses fabricated and fitted in other clinics or in private clinics

4.5. Materials

The following is a list of materials used in the study:

Informed Consent Form (Appendix 1)

Request for Ethical Approval (Appendix 2)

Data collection sheets (Appendix 3)

Questionnaire (Appendix 4)

4.6. Data collection methods

Data was collected in two phases:

a) From hospital records (dental laboratory and patient records)

b) By contacting patients and completing a series of questions via telephone related to their treatment and use of appliance. This is a qualitative aspect of the study design.

Data was thus collected from:

4.6.1. Dental laboratory technician records

From the laboratory technician records the type of the prosthesis was recorded; that is whether acrylic or chrome-cobalt prosthesis, when it was delivered and patients' personal details.

4.6.2. Patient dental records

From the patient records the researcher was able to determine the patient's age, contact details, design of the prosthesis, repairs and remakes of the prosthesis, loss of abutment teeth, patient opinions concerning the prosthesis. These were recorded in data collection sheets (Appendix 3).

4.6.3. Telephonic interviews

The information obtained from the patient dental records pertaining to the outcomes of the prosthetic rehabilitation was complemented by 15 minute telephonic interviews of the patients. The patients (a subset of the initial sample) answered 12 questions in the questionnaire (Appendix 4). Follow-up questions were asked where necessary to clarify patient answers to open ended questions. All patient participation was voluntary and informed consent was obtained before administering the questionnaire (Appendix 1 and 4).

4.7. Data analysis

4.7.1 Quantitative data analysis

The results show both qualitative and quantitative outcomes. Quantitative analysis was done with the assistance of a statistician and standard descriptive and comparative statistics were computed. Microsoft Excel (Microsoft Excel 2013, Microsoft, USA) was used to carry out a one sample or two sample t-test of significance to determine the outcome of any associations. Results are presented using tables and graphs.

4.7.2. Qualitative data analysis

For qualitative data, included to supplement the findings of the quantitative data, a smaller sample permitted a comprehensive understanding of problems experienced with RPDPs. The qualitative data, obtained from telephonic interviews, was analysed using the analytical abstraction method which has clear and logical step-by-step analysis approach (Cohen *et al.,* 2005; Cresswell, 2003). Themes present in the literature review were used as a guide in the basic coding process using Microsoft Excel (Microsoft Excel 2013, Microsoft, USA). These themes include a discussion at the basic level, which are the actual words of the respondents, and at a higher level, which are the researcher's inferences from the responses (Cohen *et al.,* 2005; Cresswell, 2003). The use of the recorded text from interviews ensured an accurate account of the patient responses.

4.8. Ethical considerations

4.8.1. Informed consent and Patient anonymity

Informed consent was sought from all patients before administering the questionnaire (Appendix 1). Patient participation in the study was voluntary and participants could withdraw from the study at any point without any repercussions. Patients requiring dental treatment (or making such requests) were referred accordingly. Patient names were not included in the report of data collected and questionnaires (Appendix 1) and each questionnaire was numbered to maintain anonymity.

4.8.2. Research project registration

This research proposal was presented to the Research Committee of the Faculty of Dentistry of the University of the Western Cape and to the Biomedical Research Committee for ethical approval and for registration as a research project (Project number BM 16/7/25).

4.8.3. Conflict of interest

The research is not supported by any research grant from any foundation or company, and the researcher declares no conflict of interest.

CHAPTER 5

RESULTS

5.1 Quantitative data analysis

5.1.1 Laboratory records

According to the technical laboratory records, 335 lower removable partial prostheses were made in the period of January 2011-June 2012. Of these, 160 were lower partial acrylic prostheses and 175 were lower partial metal (chrome-cobalt) prostheses. The researcher was able to access 269 patient files and the remaining 66 patient records were not found upon searching. Therefore, 19.7% of patient files were unaccounted for.

5.1.2 Patient records

From the patient records accessed, of the 269 partial mandibular dentures made, 152 complete patient records were found for patients supplied with either a Kennedy Class I or II mandibular dentures. Kennedy Class I was the most common, with 95 mandibular partial dentures, and 57 Kennedy class II dentures delivered. This is summarised in table 3. Fifty-two patient records were excluded, though the laboratory records indicated a mandibular partial prosthesis had been made, because the patient records were incomplete as pertaining to dental history, examination, treatment planning, and prosthesis supplied.

A total of 217 mandibular partial dentures were assessed and the occurrence and percentage prevalence of the different as shown in table 3.

Table 3: Prevalence of Kennedy classification of edentulous mandibles

Kennedy Class	Number	Percentage %
Class I	95	44
Class II	57	26
Class III	58	27
Class IV	7	3

From the complied data the obvious and immediate observations were that:

1. The designs of the RPDPs were inconsistently recorded and therefore it was not possible to relate them to the other findings,
2. The Plaque Index (P.I) and the Gingival Index (G.I) were also not consistently measured or recorded on examination, also making it impossible to determine whether these are related to outcomes,
3. Techniques that improve the design and function of distal extension RPDPs were not commonly used. This is probably because all the prosthesis in the study were made at an undergraduate level. Of the 152 prosthesis delivered to patients, 6 were designed using the RPI system, 1 was for immediate placement, and 2 were made with a lingualised occlusion. Where a prosthesis was made in the postgraduate clinic or by doctors, the records were incomplete. Any influence these techniques may have on the observed outcomes could not be determined and
4. The commonly observed outcomes were:
    a. Remakes 17% (n=26), these were usually due to poor fit, reports of pain and discomfort, mechanical failures and loss of abutment teeth,

b. Repairs 6%(n=9), these were commonly caused due to loss of an abutment and subsequent tooth addition, midline fractures or fractured clasps,
c. Extraction of abutment teeth 8% (n=12), the reasons the necessitated extractions, whether periodontal disease or caries, were not clear
d. Most patients (69%) did not return to treatment centre for follow-up

These outcomes were considered failures. Most remakes or repairs occurred within the first 2 years of denture delivery. One prosthesis in the 152 included in this study was relined and one individual had an abutment tooth restored following denture delivery. Relines and restored abutments could not be analysed as outcomes because of the minimum occurrence.

5.1.3 Age of study participants

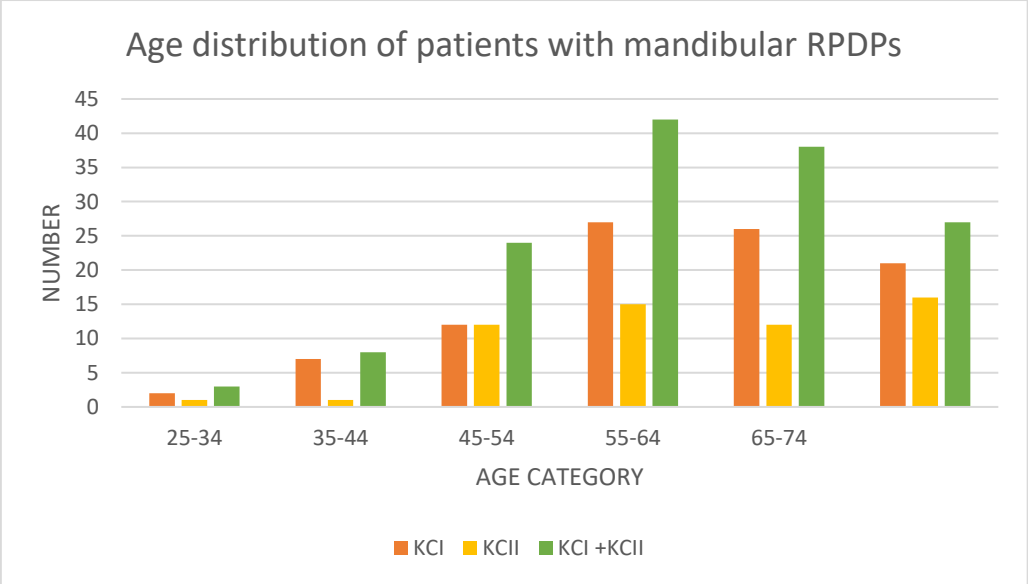
a. Age categories and mandibular distal extension RPDPs

Figure 2 shows that with increasing age the number of distal extension dentures provided to patients also increases. The least number of recipients of mandibular distal extension RPDPs occurs in the age category 24-34. The maximum number of dentures made for the different classes occurs in the following age categories:

a. For mandibular Kennedy Class I for patients aged 55-64 years,
b. For mandibular Kennedy Class II for patients aged 75 years and above and
c. For all mandibular distal extension dentures for patients aged 55-64 years.

Figure 2 also summarises the age distribution of individuals rehabilitated with mandibular distal extension prostheses. Although the number of individuals rehabilitated with mandibular distal extension dentures increases with age there is no statistically significant association between the two, with a p-value=0.432.

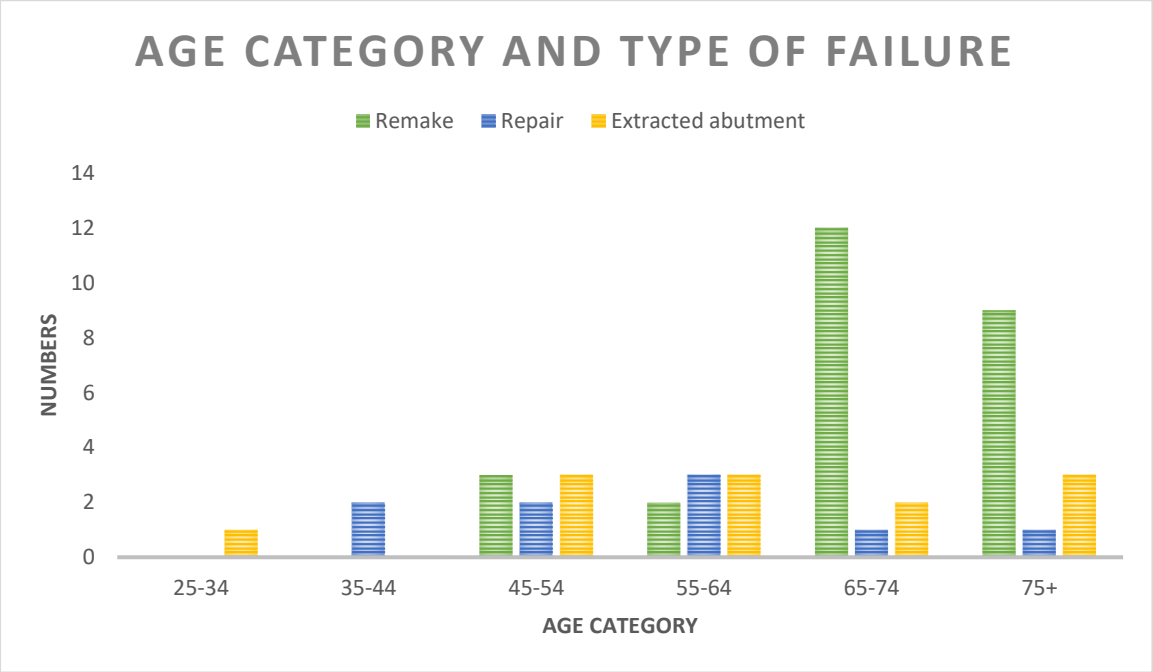
Figure 2: Age distribution of patients with mandibular RPDPs



b. Age distribution and outcomes

The most common outcome is the number of remakes. More remakes were made for the age category 65-74 and 75 years and above. No remakes were made were for individuals aged 25-34. Figure 3 clearly illustrates this finding and shows the age distribution of outcomes.

Figure 3: Age distribution and outcomes



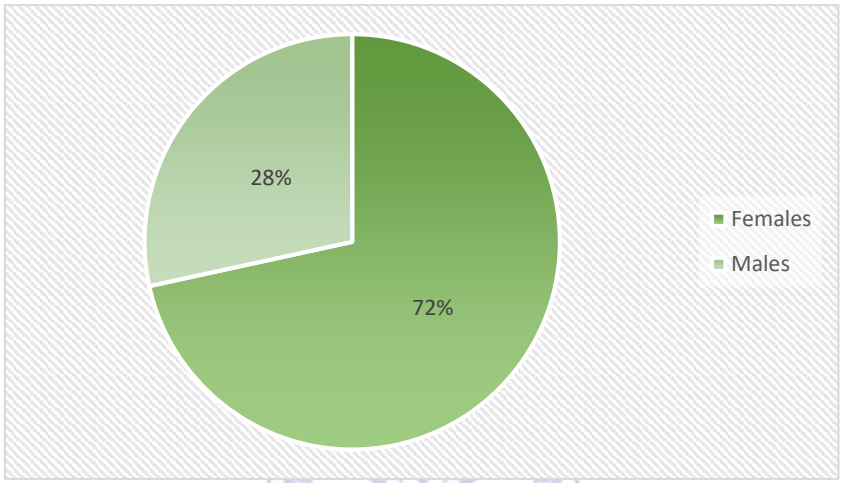
A Fisher's exact test for association was conducted between age categories and reported failures or outcomes. All expected cell frequencies were not greater than five. A statistically significant association does not exists between age categories and outcomes, $\chi 2(10) = 20.72$, $p = 0.026$. A moderate weak negative association exists between age categories and outcomes, $\varphi = -0.298$, $p = 0.119$.

5.1.4 Gender of study participants

a. Gender distribution and mandibular distal extension RPDPs

Figure 4 shows that females constitute the greater proportion (72%) of individuals that were rehabilitated with mandibular Kennedy Class I RPDPs than males (28%).

Figure 4: Gender distribution of individuals with Kennedy Class I mandibular RPDPs



Females also make up the greater proportion (58%) of recipients of Kennedy Class II RPDPs, as illustrated by Figure 5.

Figure 5: Gender distribution of individuals with Kennedy Class II mandibular RPDPs

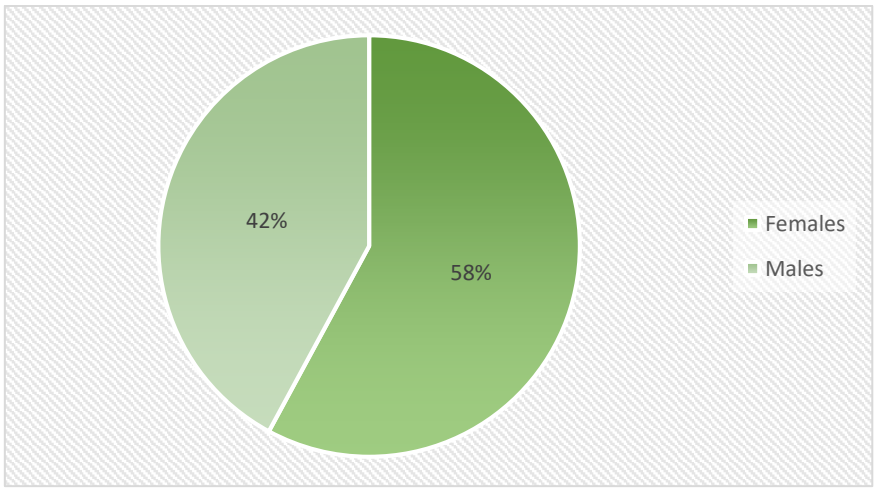
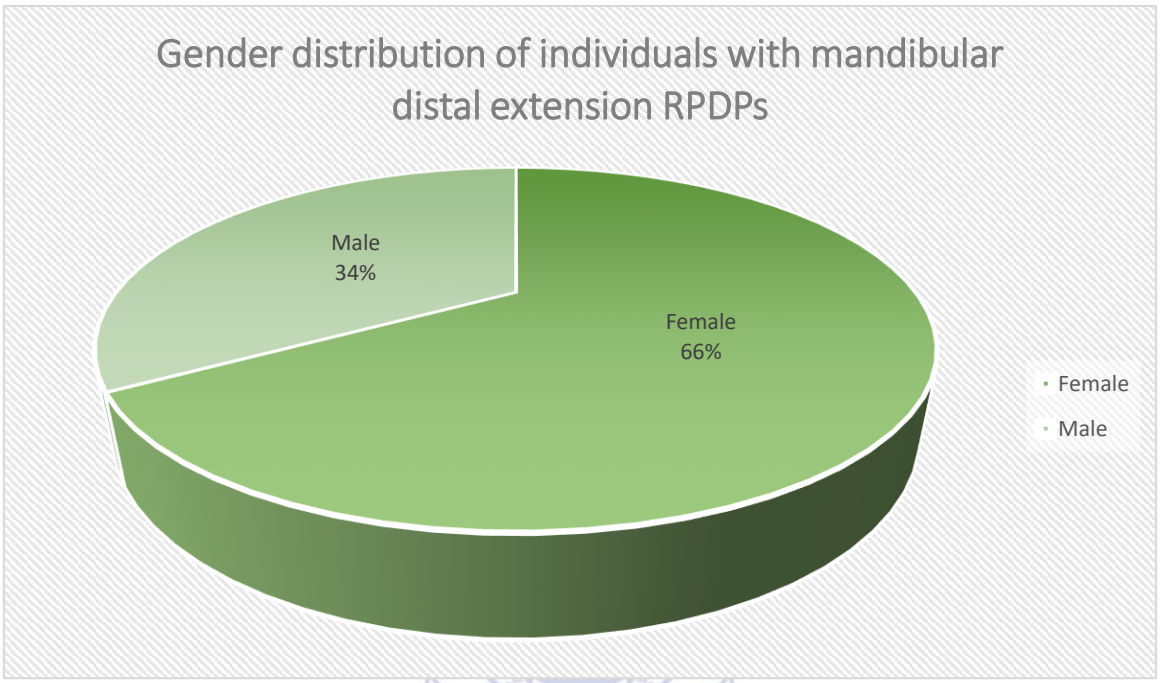


Figure 6: Gender distribution of mandibular distal extension dentures wearers

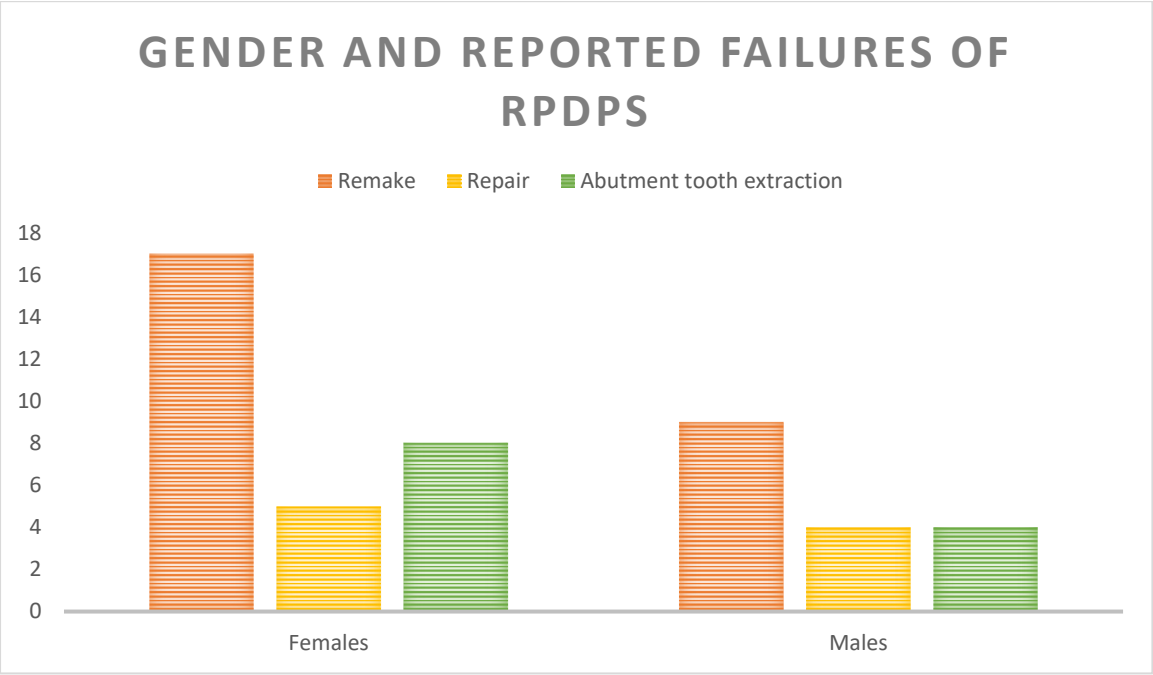


The sample is made up of more females than males, with former making 66% of the group rehabilitated with mandibular distal extension dentures as illustrated by Figure 6. A chi-square test for association was conducted between gender and Kennedy Classification to determine if a statistically significant association existed between the two. A statistically significant association did not exist between gender and Kennedy Class, $\chi 2(1) = 2.992$, $p = 0.084$. There was a moderately weak association between gender and Kennedy Classification, $\varphi = 0.1403$, $p = 0.082$.

b. Gender and reported failures of mandibular extension RPDPs

More failures were recorded for the female participants of the sample than males. The most common outcome in both gender groups is remakes. Figure 7 illustrates the occurrence different outcomes based on gender.

Figure 7: Graph showing gender and outcomes



A Fisher's exact test for association was conducted between gender and outcome. All expected cell frequencies were not greater than five. A statistically significant association did not exist between gender and outcomes, $\chi 2(1) = 0.3359$, $p = 0.844$. Therefore gender had no influence on the outcome of prosthetic rehabilitation.

5.1.5 Opposing dentition

a. Opposing dentition and Kennedy classification

The opposing dentition is categorised as:

i. Completely edentulous with full maxillary prosthesis denoted as edentulous,

ii. Partially edentulous with RPDP and

iii. Partially edentulous without RPDP.

Figure 8 summarises the occurrence of different opposing dentitions in individuals rehabilitated with Kennedy Class I RPDPs. The completely edentulous maxilla (54%) is the most common opposing dentition while the partially edentulous maxilla without an RPDP (4%) is the least common.

Figure 8: Pie-chart of mandibular Kennedy Class I opposing dentitions

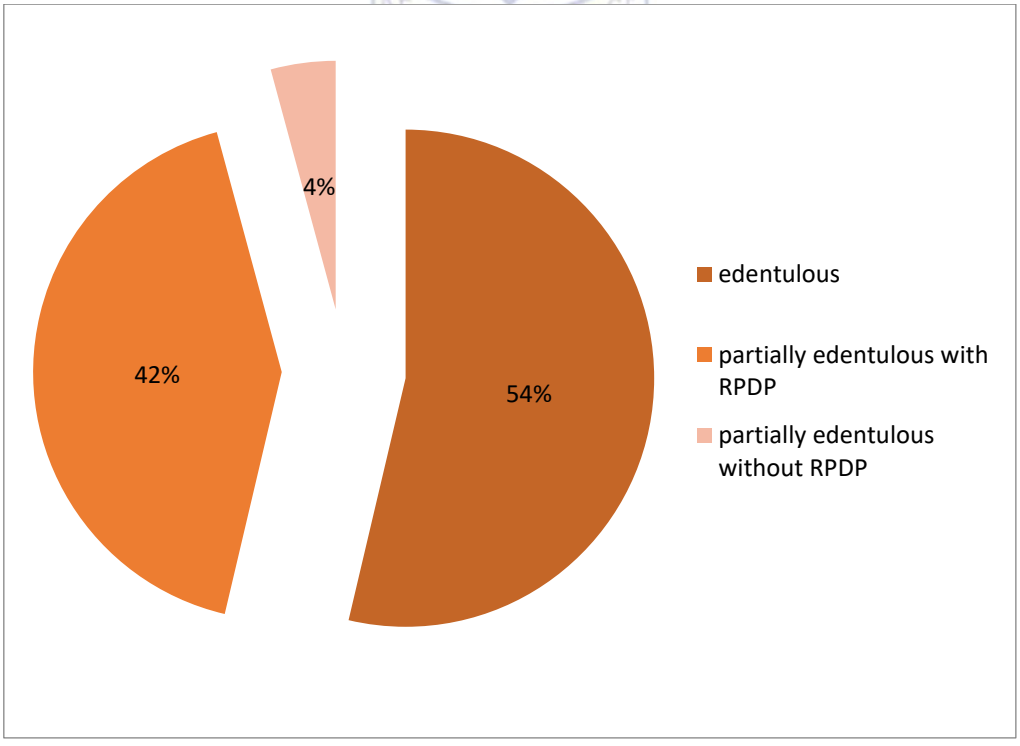
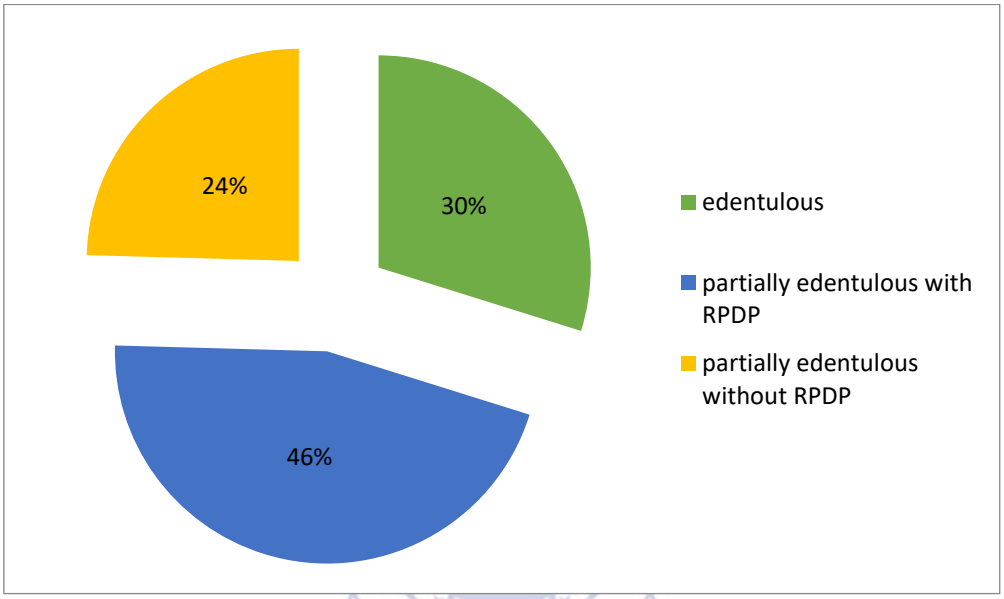


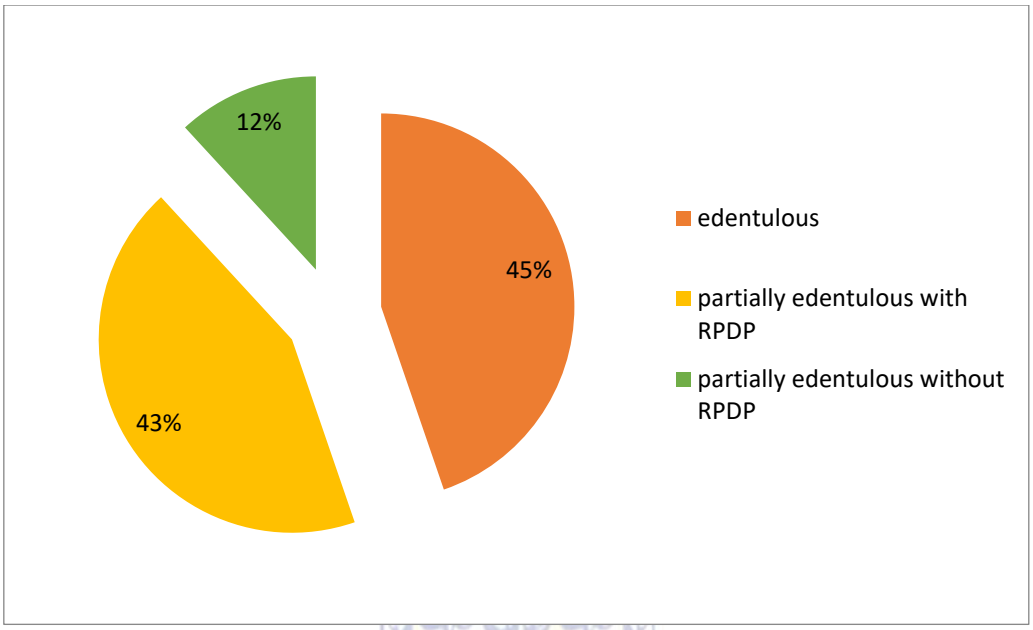
Figure 9 shows that, for Kennedy Class II mandibular RPDPs, the most commonly occurring opposing dentition is the partially edentulous maxilla with a RPDP (46%) while the least the partially edentulous without a RPDP (24%).

Figure 9: Pie-chart showing mandibular Kennedy Class II opposing dentitions



As shown by Figure 10, the most common opposing dentition for all mandibular distal extension RPDPs is a completely edentulous maxilla, followed by a partially edentulous one with an RPDP. The least common is a partially edentulous without an RPDP. Among the participants there was no individual with a complete maxillary natural dentition.

Figure 10: Pie-chart showing mandibular distal extension RPDPs opposing dentitions

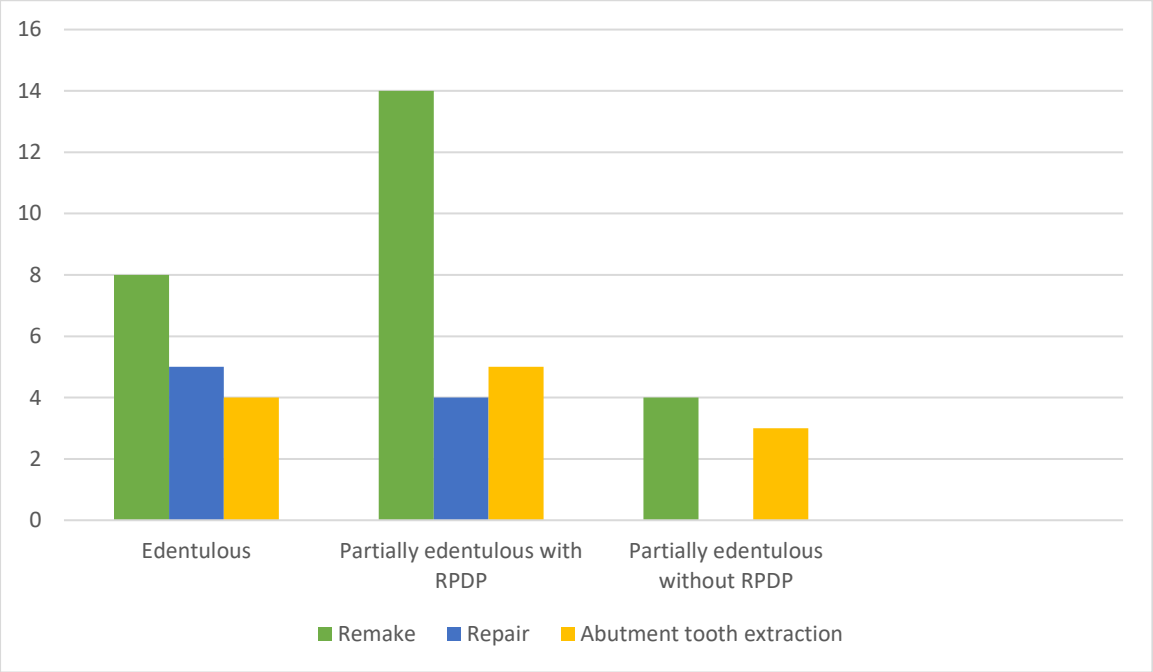


A Chi squared test for association was conducted between opposing dentition and Kennedy Classification. All expected cell frequencies were not greater than five. A statistically significant association exists between opposing dentition and Kennedy Classification, $\chi 2(2) = 17.0936$, $p < 0.0001$. A moderate weak association exists between Opposing dentition and Kennedy Classification, $\varphi = -0.286$, $p = 0.074$.

b. The opposing dentition and outcomes of mandibular extension RPDPs

Figure 11 show that for the different opposing dentitions the most common outcome of mandibular distal extension RPDP treatment is remakes. It also illustrates the distribution of outcomes based on the opposing dentition.

Figure 11: Graph showing opposing dentition and the various outcomes

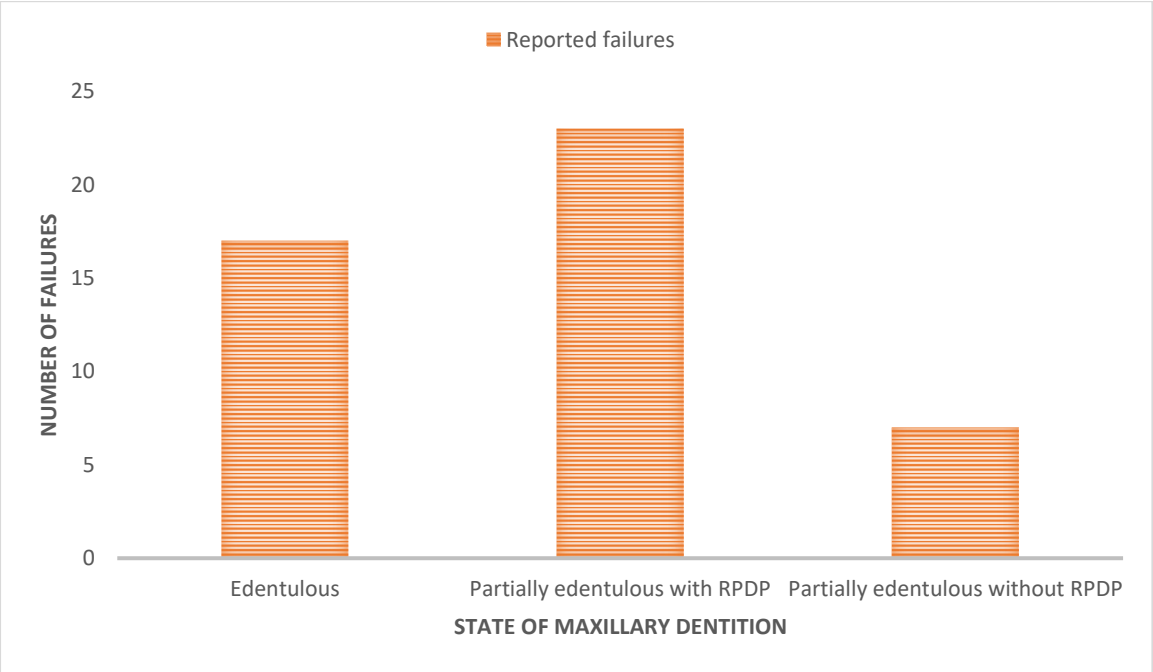


To determine whether the nature of the opposing dentition had any influence on the recorded outcomes or failures, a Fisher's exact test for association was conducted between opposing dentition and outcome. All expected cell frequencies were not greater than five. A statistically significant association did not exist between outcomes and opposing dentition, $\chi 2(4) = 3.6338$, $p = 0.531$. Therefore, the nature of the opposing dentition did not affect the outcome of the treatment.

c. Opposing dentition and outcomes

Figure 12 shows that patients with a partially edentulous maxilla with an RPDP opposing the distal extension denture had the greatest number of failures. This finding though, is not statistically significant.

Figure 12: Shows opposing dentition and total outcomes

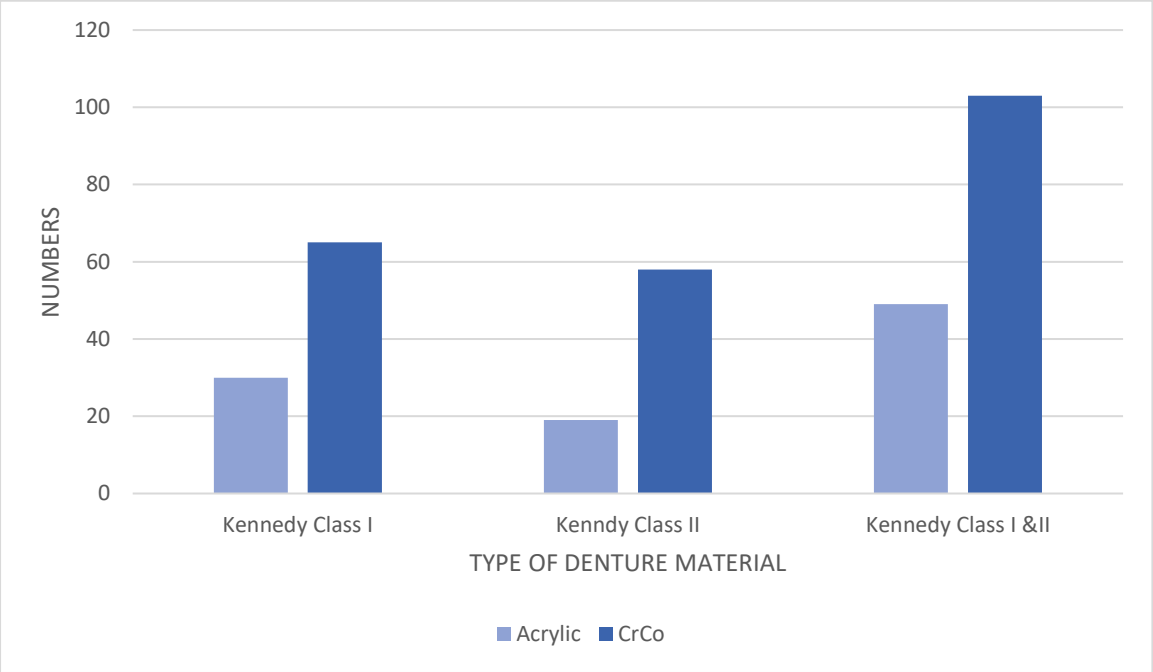


5.1.6 Denture material

a. Type of denture material and distal extension RPDPs

According to the illustration in Figure 13 the chrome-Cobalt or metal dentures were the most commonly made for mandibular distal extension RPDPs.

Figure 13: Graph of denture material of distal extension RPDPs

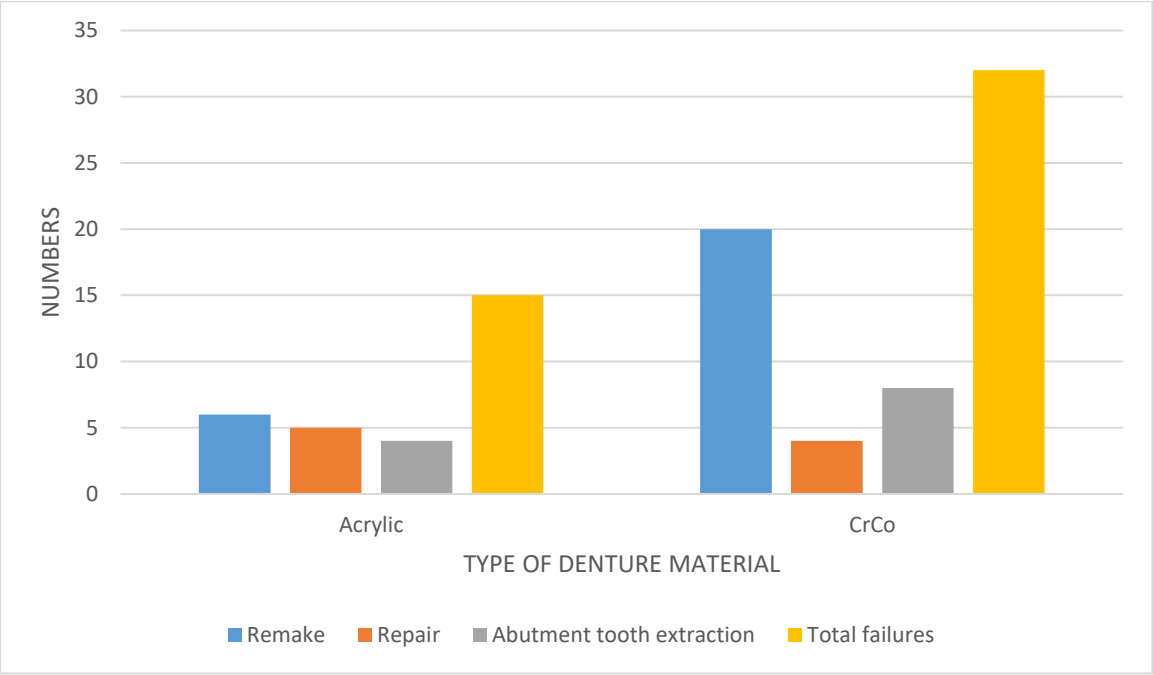


To determine if an association exists between denture material and Kennedy Classification a Chi squared test was carried out. All expected cell frequencies were greater than five. There was no association between denture material and Kennedy Classification, $\chi 2(1) = 0.0502$, $p = 0.823$.

b. Type of denture material and outcomes

Having the denture remade is the most common outcome for both the types of denture materials as shown by Figure 14. The graph also shows that the most failures occurred with dentures made with chrome-cobalt.

Figure 14: Graph of the denture material and the outcomes



A Fisher's exact test for association was conducted between type of denture material and outcome. All expected cell frequencies were not greater than five. A statistically significant association did not exist between type of denture material and outcome, $\chi 2(2) = 3.2605$, $p = 0.19$. The type of denture material, therefore, did not influence the resulting outcome.

5.1.7 Number of recalls and mandibular distal extension RPDPs

a. Median number of recalls per type of Denture Material Used

A Mann-Whitney U test was done to determine if there were differences in engagement score between acrylic and metal denture materials. Distributions of the recall count for acrylic and metal denture materials were not similar, as assessed by visual inspection. Recall rates for acrylic dentures (mean rank = 3595.5) was not statistically significantly different from metal dentures (mean rank = 8032.5), z = -0.649, p = 0.5163.

Table 4: Mean number of recalls per denture outcome

Outcome	Mean (SD)	*p*-value
Remake	1.19 (1.06)	0.4873
Repair	0.778 (0.83)	
Abutment tooth extraction	1.25 (0.86)	

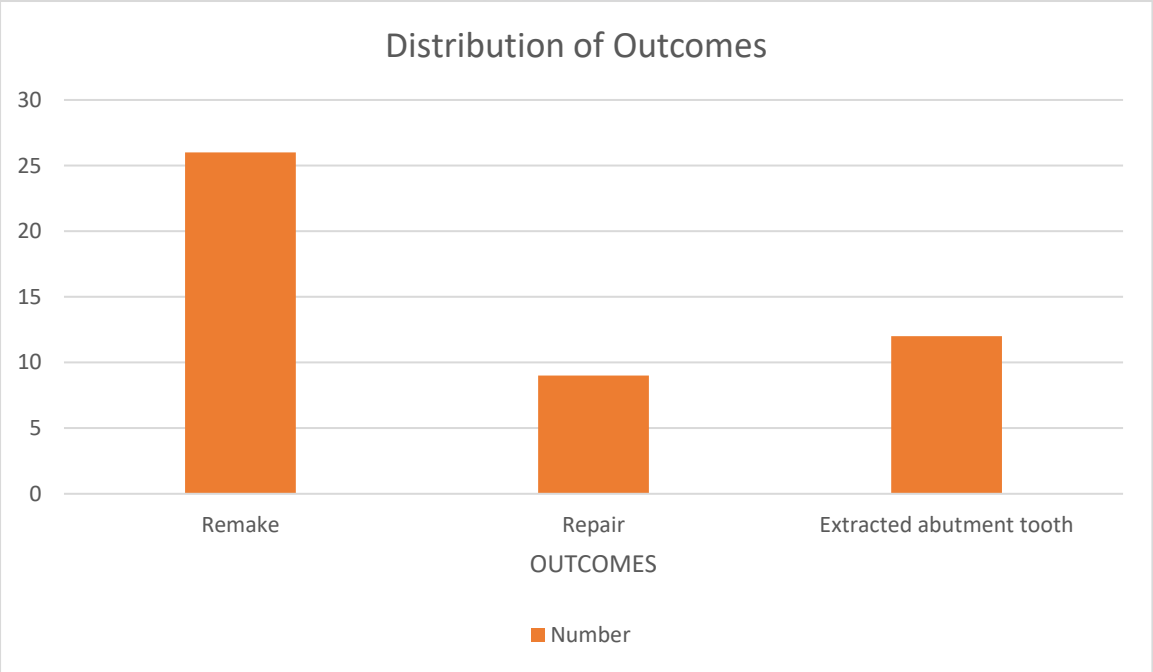
A one-way ANOVA was conducted to determine if there was a difference in recall times between participants who had repaired, remade or had an abutment tooth extracted. There were no outliers, as assessed by boxplot; data was normally distributed for each group, as assessed by Shapiro-Wilk test (p > 0.05); and there was homogeneity of variances, as assessed by Levene's test of homogeneity of variances (p = 0.702). Mean recall frequency for participants with repairs was 0.78, (std dev 0.83), for participants who requested a remake of their denture mean frequency was, 1.19, (std dev 1.06), for participants who had an abutment tooth extracted

it was, 1.25 (std dev 0.86). The differences between these outcomes were not statistically significant, F (2, 44) = 0.73, p = 0.4873.

5.1.8. Quantitative outcomes of mandibular distal extension rehabilitation

From the quantitative analysis the most common observations were that the patients did not return for follow-up treatment, the prosthesis was remade or repaired or the patient lost an abutment tooth. Since the remakes or repairs occurred within a short period of time (all occurring within 2 years of denture delivery) they are considered to be treatment failures as is the loss of abutment teeth. The total number of these failures was 47 from the sample of 152 (31%). The researcher is tentative in calling the remainder of patients successes because when the sample for interviews was drawn from them it became apparent that that was not always the case. The graph in Figure 15 illustrates the distribution of these outcomes.

Figure 15: Number of different outcomes



About 27% of the remakes were prompted by the loss of an abutment tooth. Half of the repairs were tooth additions after the loss of an abutment tooth. There was, however, no statistically

significance between any of the outcomes including the loss of abutment teeth and the other measured variables.

5.2 Qualitative data analysis

A detailed summation of the responses to the questionnaire are tabulated in Appendix 5. Other details relating to the interviewed sample are as follows:

a. Age: the participants ages ranged from 51-90 years old with a mean age of 69.5 years,
b. Gender: the group comprised of more female (constituting 80% of sample) than male participants,
c. Denture material: metal (chrome-cobalt) dentures, constituting 70% of sample, were the most common mandibular prosthesis than acrylic (30%) and
d. Opposing dentition: completely edentulous maxilla were the most common (50%), followed by partially edentulous with a RPDP (40%) and the least common were partially edentulous without a RPDP.

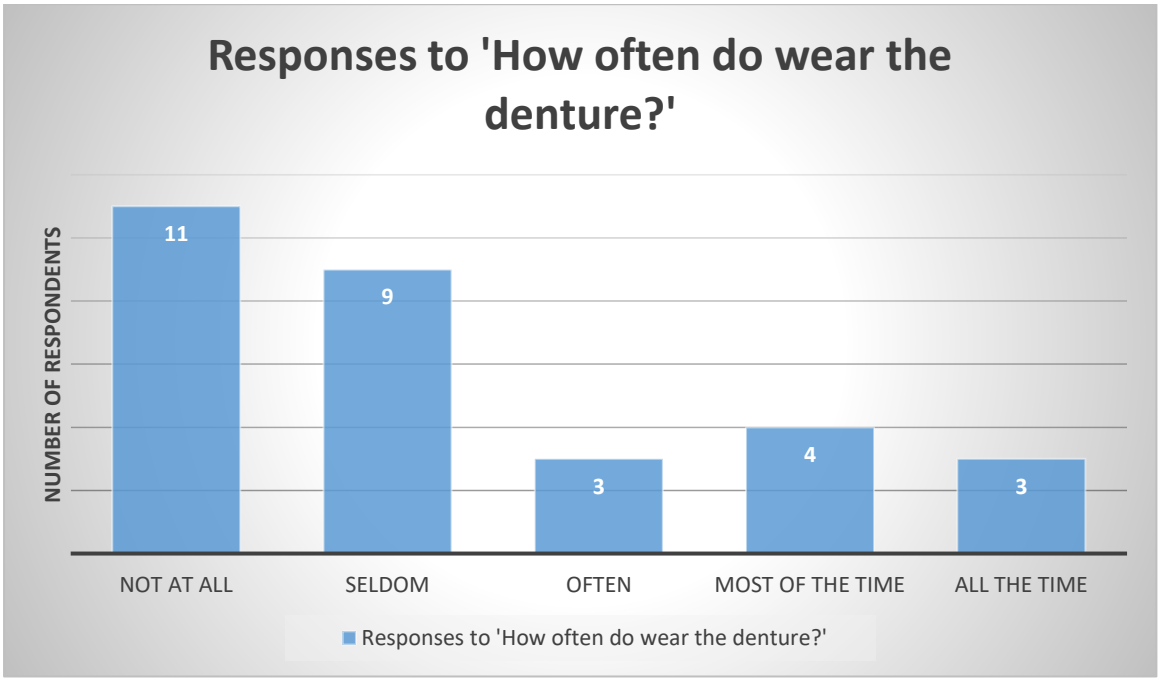
5.2.1 Basic and Higher Level Analysis

The qualitative findings are a record of the telephonic interviews between the patients and the researcher. They give a broader understanding of patient's RPDP experiences such the frequency of use and the positive impact of the prosthesis on their lives. These findings were reported on three broad categories, namely, *Basic* and *Higher levels* and then the *conceptual analysis* of these two levels. The basic and higher levels are reported in themes, firstly guided by the literature and secondly by those that become apparent after the analysis

The themes guided by the literature were: the frequency and impact of wear, replacement and satisfaction with RPDPs. Patient comments recorded with regards to the frequency of wear indicated that most patient *did not wear the denture at all* or *seldom wore* them and the reasons

given were ‘discomfort’, ‘painful’, ‘didn’t fit properly’ and ‘can’t eat or chew with it’. The responses to the questionnaire are tabulated and summarised in Appendix 5. Their comments also centred on the position and poor aesthetics of the clasps necessary for retention.

Figure 16: below illustrates the responses to frequency of wear



The responses of patients regarding the replacement of dentures were hardly answered, and those who responded said ‘they did not go back for another denture’ or ‘they were on a waiting list’.

Figure 16 graphically represents the scores individuals gave the prosthesis and illustrates the level of satisfaction with dentures, patients who reported negatively on a scale of 1 to 10, were mostly clearly unsatisfied with satisfaction scores below 4. The state of the denture did not

have the required outcome expected by them as they indicated a negative impact on wear such as ‘nothing improved with their denture’.

The contrary was obviously true for those who patients who reported wearing their ‘denture all the time’ or ‘most of the time’, as they were totally satisfied (with scores of 6 or more) and did not require replacement dentures. These individuals reported positive impact on chewing and functioning.

5.2.2 Emergent themes

Furthermore, three emergent themes which became apparent from the basic analysis of the qualitative data were extrapolated and discussed further.

a. Denture recall

All the RPDP patients wanted these appliances hoping to have an improvement in their aesthetics and functioning, but many were clearly disappointed. Many of the patients seemed unaware of returning to the treatment centre to have these denture problems corrected, which could have improved the denture experience, as many returned for other reasons such as scaling and restorations.

b. Communication

Moreover, communication between the clinician and patients is key to successful treatment. Enquiring the patient’s expectation regarding the treatment procedure and what they need the prosthesis for before treatment is important. If they require a prosthesis for aesthetics they are

likely not to wear it all the time but only when they go out. If the prosthesis is for function they should be aware that they must return if there are any related problems. It is important to understand what patients have heard regarding the procedure from peers as this can influence their attitude towards RPDPs.

c. Patient education

Educating patients about the importance of RPDP components and oral care contributes greatly to the success of partial denture treatment. Patients were not cognisant of all the factors ensuring successful RPDP treatment such as patient, biological or biomechanical influences. It is the clinician's role to educate patients and to ensure that they are aware of other treatment options available when RPDPs did not meet their expectations.

5.2.3. Conceptual Analysis

Successful patient treatment includes an understanding of the patient, their needs and expectations, not just supplying them with a prosthesis and hoping for the best. Treating patients holistically is vital, even for the success of RPDPs.

Moreover, treatment does not end with the delivery of the appliance and patients need to be informed of any recall protocol. There are also other options of rehabilitating missing teeth could have given greater satisfaction to these patients but these were not communicated to them. Patients must know they have a say in their treatment and how it is conducted, within the ethical principles of treatment of course.

CHAPTER 6

DISCUSSION

6. 1. Patient education, examination, diagnosis, treatment selection and planning

6.1.1. Patient education

The success of prosthetic rehabilitation is the shared responsibility between the clinician and the patient (Carr & Brown, 2011). The initial step in treatment is patient education. This continues throughout the treatment and maintenance stages. The patient must understand the benefits and limitations of the treatment to lower impossible expectations and prevent misuse of the prosthesis. The patient has a role to play in maintaining the oral tissues and the denture prosthesis through consistent hygiene practices (Carr & Brown, 2011). The delivery of the denture does not signify the end of treatment but the patient is expected to attend follow-up visits to mitigate, at an early stage, any adverse effects of wearing the denture (Bergman *et al.*, 1982; Vermeulen *et al.*, 1996; Jorge *et al.*, 2012).

Patients observed by this study seemed to have received no or inadequate education concerning treatment with RPDPs. A significant proportion did not return to the treatment centre for monitoring. Those that returned after initial treatment presented with failures such as loss of abutment. The loss of abutment teeth could have been prevented if periodic recalls had been maintained by restorations, cleaning or root planning and reinforcement of oral hygiene instructions as demonstrated in other studies (Chandler & Brudvik, 1984; Jorge *et al.*, 2012).

Patients with complaints about discomfort or pain from the prosthesis, also did not return to the treatment centre and were identified through the telephonic interview. These patients choose not to wear the prosthesis instead.

6.1.2. Patient examination, diagnosis, treatment selection and planning

Clinical and radiographic examination of oral structures, evaluation of occlusal plane, arch form and inter-arch relations and mounting diagnostic casts allow the clinician to make an accurate diagnosis. The diagnosis allows for the selection of a suitable treatment choice (Carr & Brown, 2011). Not all partially edentulous patients in this study should have be managed with RPDPs. Patients showing poor adaptability to previous removable dentures may have benefited from fixed alternatives instead of multiple remakes (Sunnegardh-Groneberg *et al.*, 2012). Certain individuals in the study population had the distal extension RPDPs remade 3-4 in the period of observation. The treatment choice based on the diagnosis was, therefore, poor.

Of the interviewed patients, many reported not wearing the mandibular denture prosthesis. These patients were adequately functioning using a complete maxillary prosthesis and the remaining anterior mandibular teeth. The necessity of the mandibular prosthesis comes into question as the treatment choice of a SDA is clearly superior (Kayser, 1981; Witter *et al.*, 1999; Armellini & von Fraunhofer, 2004). Though clinicians demonstrate a knowledge of SDAs as an acceptable treatment option (Khan et al., 2012; Armellini & von Fruanhofer, 2004), this study shows that it is not implemented often enough. Since the prostheses investigated in this study were made by undergraduates, they are also not using the concept often enough or unable to identify patients it is suited for.

Chandler and Brudvik (1984), recognise the use of the altered cast technique as basic for all distal extension dentures made in American dental schools. Carr and Brown (2011), include it as part of the six phases to providing a distal extension denture, citing that it provides the best support for the longest time. The technique was not used to make the 152 prosthesis made in this study. This study cannot ascertain the claim that it improves the positive outcomes of the distal extension dentures as observed by the abovementioned authors.

The use of the RPI was also limited in the sample population, with only 6 prosthesis of this nature made. It maybe that it was not a suitable design to the patients treated or the clinician did not identify patients it suited during diagnosis. A number of abutment teeth were lost during the observation period. Abutment tooth loss accounted for 27% of remakes and 50% of repairs as tooth additions. Whether the torques releasing nature of the RPI could have reduced the number of teeth lost cannot be determined. The reason prompting extraction of the abutments is not clear, whether caries or periodontal disease (Bergman *et al.,* 1982; Chandler & Brudvik, 1984; Wagner & Kern, 2000) or the action of the denture as a Class I lever (Krol, 1973; Ben-Ur *et al.,* 1999; Dhingra 2012).

Precision attachments and implant support were not used for the 152 dentures evaluated. They may not have been a viable options for the patients though they have been shown to improve acceptance of RPDPs. Precision attachments eliminate the need for unsightly clasps and allow occlusal loading to be directed along the long axis of the tooth (Rani *et al.,* 2016). Some of the patients interviewed, did not like the visibility of the metal clasps. The level of their acceptance and satisfaction could have been improved by use of precision attachments (Rani *et al.,* 2016). This could also have been identified in the diagnosis and treatment selection phase. Implants

improve support of distal extension bases, distribute occlusal load evenly and minimise transmission of non-axial forces through the abutment teeth (Brudvik, 2003). The choice to incorporate implant in treatment is determined by the suitability of the patient to the treatment. Such patients, may have been screened out as not suitable for management by undergraduate students who made the prostheses evaluated in this study.

In conclusion, poor patient education, diagnosis and treatment selection (Carr & Brown, 2011) contributed to some of the outcomes observed in the study.

6.2. Record keeping

A discrepancy exists between the patient laboratory records and patient files. The laboratory records having made more prosthesis than those accounted for in the patient files. This indicates poor record keeping on the part of the clinician. A number of files were missing, or contained an incomplete record of treatment or had none or only part of a patient's history. Faculty members of staff and postgraduate students were guiltier of this offense than the undergraduate students, hence all the prosthesis analysed were those made by the latter. It, therefore, was not possible to determine if this factor influenced the outcomes observed. The importance of clear and complete records cannot be stressed enough, for medico-legal and forensic purposes. When examination and dental history is poorly recorded it is not clear whether it was carried out at all.

Gingival Index (G.I.) and Periodontal Index (P.I.) were used to monitor the impact of the RPDPs on the oral health status by several authors (Bergman et al., 1982; Chandler & Brudvik, 1984; Jorge et al., 2012). They recorded these values at periodic recalls and used them to determine negative changes associated with RPDP wearing. Higher gingival inflammation was observed in area covered by denture framework (Chandler & Brudvik, 1984). There were no evident changes in these values or pocket depths and tooth mobility observed by Bergman and colleagues (1982). The values were inconsistently recorded in the patient files assessed and no comparisons could be made.

6. 3. Prevalence and incidence of mandibular tooth loss

When describing the pattern of tooth loss, Jeyapalan and Krishan (2015), noted that younger individuals tend to present with Kennedy Class III and IV partial edentulism. The fact that none of the individuals in the sample had all their maxillary teeth indicates the high occurrence of tooth loss.

They also observed that Kennedy Class I and II were more common in the mandible. Their findings are similar to those of this study. Few participants, wearing distal extension RPDPs, fell into the younger age categories with most occurring in the 55-64 years range. On the other hand, the World Health Organisation (WHO), indicate that the highest prevalence of partial edentulism occurs between the ages of 34-44.

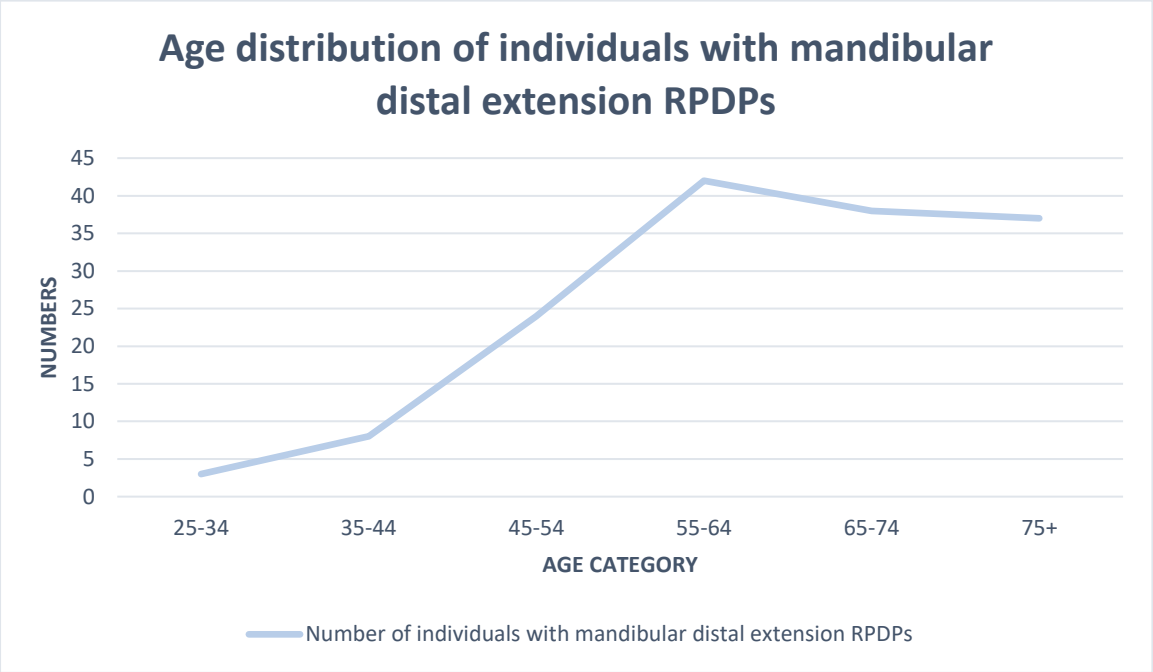
The pattern of Kennedy Classification observed in the mandibles of the participants of this study most resemble those observed by Curtis et al., (1992) and Keyf et al., (2001) as shown in Table 5.

Table 5: Shows how the distribution of Kennedy Classification compares to those in literature

Author	Class I	Class II	Class III	Class IV
Curtis et al., (1992)	40%	33%	18%	9%
Keyf et al., (2001)	43%	38%	18%	0%
Present study	44%	26%	27%	3%

Prabhu and colleagues (2009) also noted that with increasing age there was increase in occurrence of Kennedy Class I and II which was also apparent in this study as below:

Figure 17: Graph shows the age distribution of wearers of mandibular distal extension denture wearers



Kennedy (1960) points out that younger people will not have lost enough teeth to compromise function or aesthetics to seek prosthetic rehabilitation. Contrary to this, another may also argue that this observation maybe as a result of greater treatment seeking behaviour of the older population, rather than increase in occurrence of Kennedy Class I and II edentulism.

6.4. Indications of Kennedy Class I and II rehabilitation

Wostmann and colleagues (2005) investigated the indications of RPDP rehabilitation and found that these were namely, to improve masticatory function, nutrition and quality of life. During patient telephonic interviews, the patients identified the need to improve chewing as the main indicator of having a mandibular distal extension dentures. This indication pertains to both the ones satisfied and dissatisfied with treatment. Satisfied patients, who scored the prosthetic treatment as 6 or higher, were pleased with how the denture improved their mastication. Dissatisfied were upset about the prosthesis not improving chewing and instead causing discomfort.

Individuals with more than three occluding pairs were unlikely to use the prosthesis if they experienced discomfort (Wostmann *et al.*, 2005). This was also observed in the current study. Twenty patients, out of the 30 interviewed, reported not wearing the denture at all or seldom. The frequency of use of the mandibular distal extension denture was low if the patient experienced discomfort or pain. The ones that opted not to use the prosthesis at all, were seemingly functioning well with a complete maxillary prosthesis and the remaining anterior mandibular teeth. These patients would have been better suited for management as SDAs (Armellini & von Fruanhofer, 2004) and not indicated for distal extension RPDPs.

Therefore, the reason patients sought treatment for mandibular Kennedy Class I and II was to improve chewing. If this expectation was not met without discomfort or pain the prosthesis was not worn. The reasons given for not wearing it were mainly discomfort, pain, poor fit and

inability to chew. Patient acceptance and satisfaction have been recorded as poor when prosthesis (Preshaw *et al.*, 2011):

- replaced posterior teeth only,
- replaced a few posterior teeth and
- replaced a few occluding pair.

This was also observed with the individuals observed in this study. Therefore the most important expectation to meet when supplying a prosthesis for these regions is to improve mastication while minimising discomfort. To a large extent this expectation was not met for the individuals observed in this study.

6.5. Outcomes of mandibular Kennedy Class I and II rehabilitation

As mentioned in the literature, the factors influencing successful mandibular distal extension denture rehabilitation are categorised as mechanical, biological, biomechanical and patient related (Budtz-Jorgensen, 1996; Witter *et al.,* 1999; Wagner & Kern,2000; Dhingra, 2012;). These factors influence three main areas of prosthetic rehabilitation outcomes:

- impact on oral health status as determined by loss of abutment or number of restored teeth
- the status of the prosthesis as determined by relines, rebases, remakes and repairs and
- patient opinions concerning the treatment and denture prosthesis (Bergman et al., 1982; Chandler &Brudvik, 1984; Vermuelen et al., 1996; Koyama et al., 2010; Preshaw et al., 2011 & Jorge et al., 2012).

6.5.1. Impact of RPDP on oral health status

Wearers of RPDPs are prone to tooth loss as a result of periodontal breakdown and caries. Higher levels of bacteria have been recorded in the mouths of patients with RPDPs and complete dentures (CDs) than those without or with fixed prosthesis (Wagner & Kern, 2000). Wagner and Kern reported that 64% of patients evaluated after 10 years of wearing RPDPs had oral hygiene problems and high rates of extractions. These observations concur with those of the current study. The most commonly observed outcome was remake of the denture, accounting for 55% of the observed outcomes followed by loss of abutment tooth (25%). When considering the outcome, if a denture was remade for loss of an abutment the outcome recorded

was denoted ‘remake’. When a repair was done to add an extracted tooth the outcome was denoted ‘repair’. With this in mind, the loss of abutment occurs more commonly than remakes and repairs for fractures. Fifty-five percent of repairs were for tooth additions following the loss of abutment. While about 31% of remakes were following the extraction of an abutment. The reason for this failure was not always recorded in the files, whether caries, periodontal disease or unfavourable mechanical forces applied to abutments.

Studies that show a low percentage of caries, abutment tooth loss and periodontal disease incooperated a system of periodic recalls to insure that the negative influence of RPDP on the oral health status was minimised (Bergman *et al.*, 1982; Chandler & Brudvik, 1984; Vermeulen *et al.*, 1996; Preshaw *et al.*, 2011; Jorge *et al.*, 2012). A system of recall was not apparent in the participants of the present study and seemed to be patient initiated after one experienced a problem. This probably explains why restorative procedures were rare, only one patient had a restoration following RPDP rehabilitation. The conclusion made concerning this observation was that the patients were not returning in time for tooth-saving measures to be done. The outcomes observed by the current study highlight the importance of a system of periodic recall to maintain health of oral tissue (Vermeulen *et al.*, 1996). The importance of regular and consistent oral hygiene practices by the patients is also highlighted by this outcome (Bergman *et al.*, 1982; Chandler & Brudvik, 1984; Vermeulen *et al.*, 1996; Preshaw *et al.*, 2011; Jorge *et al.*, 2012).

In the 152 mandibular distal extension dentures fitted for participants of this study, techniques that minimise biomechanical failures were rarely used. These techniques are namely:

a) Altered cast impression technique (Chandler & Brudvik, 1984; Feit, 1999; Carr & Brown 2011),
b) RPI denture design (Krol, 1973; Ben-Ur *et al.*, 1999),
c) Shortened dental arch (SDA) (Armellini & von Fraunhofer, 2004)
d) Use of precision-attachments (Rani et al., 2016) and
e) Incorporation of implants (Zancope et al., 2015).

Most authors believe that the recording of denture bearing mucosa of distal extension must be done with a degree of loading such as with the altered cast technique (Chandler & Brudvik, 1984; Carr & Brown, 2011). This techniques was not utilised for the prosthesis evaluated here. Six prostheses were made using a torque-releasing design like the RPI. The treatment options of an SDA, precision attachments and implants were not used at all. Whether the loss of abutments was attributed to the prostheses acting as Class I levers around the abutment or due to caries and periodontal disease cannot be ascertained. The researcher believes the outcome of loss of abutment in this study can be attributed to multiple factors; poor oral hygiene practices by the patient, inadequate patient education about maintenance, and poor selection of treatment options and denture design.

6.5.2. Status of the prosthesis

Mechanical failures such as fractures of major and minor connecters, framework and flanges may occur. These may prompt repairs, remakes and relines (Witter *et al.*, 1999; Budtz-Jorgensen, 1996). Relines and rebases were uncommon in the prostheses that were evaluated in this study. Most failures resulted in repairs and remakes. Most repairs were attributed to tooth addition following abutment tooth extraction, while 45% were for fractures, particularly

midline fractures occurring in acrylic prostheses. Remakes were prompted by three reason: complaints about the fit of the denture, lost abutment teeth and fractures. This is a departure from the pattern observed in literature where fractures are the cause of repairs and remakes (Vermeulen *et al.*, 1996). In contrast to Vermeulen *et al.*, (1996), Jorge and colleagues (2012) reported fewer fractures of framework leading to remakes. The present study indicates that remakes and repairs are not only a parameter for measuring the status of the prosthesis but also of oral health (in the case of lost abutments) and patient satisfaction (in case of complaints about fit).

6.5.3 Patient opinion

This part of the study emerged as very important part of the outcomes. Clinicians tend to be concerned with restoring function without realising how much patient opinion influence the frequency of wear (Preshaw *et al.*, 2011). While speaking to patients during the interviews it became apparent that the most important patient factor in the success of treatment was the perceived benefit of the prosthesis and level of comfort (Preshaw *et al.*, 2011). If patients were dissatisfied with the treatment they were unlikely to wear the prosthesis. This reason was the cause of most failures in the interviewed group. Had this type of qualitative analysis not been included these aspects would not have been known.

Patient satisfaction with an RPDP is a function of (Koyama et al., 2010):

- aesthetics,
- patient personality,

- physical adaptability and
- social adaptation.

Koyama and colleagues (2010) carried out telephonic interviews of patients that received an RPDP. Their criteria of determining successful frequency of wear was:

a) Successful- original RPDP was worn daily for 5years
b) Remake-original replaced within 5years,
c) Failure- RPDP not used or used sporadically.

The sample size they used was of 90 prosthesis and they found 61% (n=55) successful outcomes, 23% (n=21) remakes and 16% (n=14) failures. The present study interviewed 30 patients that had been provided with RPDPs 5-6years earlier. Twenty of the patients identified not wearing the prosthesis at all or seldom, constituting two thirds of the sample which is a larger proportion compared to the one observed by Koyama *et al.,* (2010). Patient reported no perceived benefit to chewing with 15 scoring the prosthesis a 4 and below. These patient were drawn for the initial sample and had not returned to the treatment centre for further management. This, therefore, is an outcome that could not be determined by perusing through patient clinical records.

Denture usage was observed to decrease with increasing age, posterior edentulous spaces and number of occluding pairs (Koyama *et al.,* 2010). This was also observed in the interviewed group in the present study. Most remakes prompted by dissatisfaction were observed in the age group 65 years and above in the both the present study and that by Koyama and colleagues. The poor adaptability and acceptance could be associated with:

- reduced motor function required to function with prosthesis,
- greater alveolar ridge resorption with age,
- presence of severe and chronic illness in older population,
- age compromised oral health status (fewer retained teeth) and
- changes in personality that occur with age (Koyama et al., 2010)

By the assessment of the technician and patient records, the researcher is able to determine values like the number of;

- mandibular distal extension dentures made,
- patients that teeth restored or lost abutment teeth and
- prostheses that were relined, repaired or remade.

These values particularly refer to patients that were retreated at Tygerberg Oral Health Centre following initial denture delivery. The values could then be analysed to determine if any significant associations existed between these findings and the other variables measured (age, gender, denture material, opposing dentition and number of recalls). The qualitative analysis serves compound these findings to the patient experience. Through the qualitative data, it can be inferred that,

- patients who experience a negative outcome do not always return for follow-up treatment,
- remakes of dentures can be prompted by patient dissatisfaction rather than a mechanical failure and
- patient education, understanding of treatment and their role in caring for their teeth and the prosthesis is poor.

For both methods, older patients had more complaints or were dissatisfied. Quantitatively, once a patient had a complaint, their patient initiated recalls increased. In contrast to this, the qualitative analysis showed that patients with complaints were unlikely to access further treatment.

6.6 Limitations of study

6.5.1 Prostheses were made by undergraduate students and by different operators

Though it is acknowledged that the skill of the operator contributes to the final prosthesis fabricated, this study did not investigate that factor. It was assumed that all prostheses fitted in the patients met an acceptable standard according to institutional protocol as these were completed under supervision of qualified clinicians. The ideal would have been to access prostheses made by one individual to eliminate the influence different operators have on the final outcome. It is also assumed that the prostheses were not used to perform any other functions than their intended purpose.

6.6.2 Failure to interview all individuals in initial sample

During the recording of outcomes from the patient files, the researcher was unable to ascertain the outcomes of treatment of all patients because most never returned to the treatment centre for further management. In the records, these are therefore considered as successful treatment. This is obvious not true, as the patients may have sought the services of other dental institutions or private practitioners. This also became apparent in the group interviewed because the patients reporting dissatisfaction with treatment had not returned to the treatment centre. The researcher could not interview all the individuals in the initial sample as some could not be reached, had relocated or had their numbers disconnected. The ideal situation would have been to be able to contact all the people in the initial sample to ascertain the true number of successful outcomes.

6.6.3 Limitations of telephonic interview as a data collection tool

Telephonic interviews are advantageous as a data collection tool as they allow a high response rate, can be conducted quickly and allow targeted sampling and access to a wider demographic especially with cell phone usage. When conducted well, high quality information can be collected.

The researcher found that it was difficult to ask complex questions over the phone that required explanation like the clinical status of teeth or the prosthesis. People may confuse the researcher with telemarketers and therefore refuse to speak to them. The researcher, though, was fortunate enough not to encounter this. Most patients were eager to comment on the experience of their treatment.

The interviewer was not able to observe the interviewee's body language, which is an important part of communicating feelings. The interviewees were not able to proof read what the researcher entered as their response to questions or what the inference to them was. Telephonic interviews are more expensive when compared to online surveys but all patients in the sample did not provide an email address. This maybe because at the time they were treated they did not have email addresses.

The interviews were conducted in English, while most participants listed their first language as Afrikaans. The investigator was unfortunately not an Afrikaans speaker. This may have influenced the interviewee's understanding of the questions as well as that of the interviewer's of the responses.

6.6.4 Limitations of the study design

The study design is a retrospective observational study and not a clinical trial and its results must be interpreted with care. Patient recall was not according to an organised system but patient initiated and prompted by problems they had encountered. This is a problem because not all patients returned for follow-up treatment. The clinical outcomes recorded were from patient files. A better design would have been to physically recall the patients and revaluate their oral health status but this was beyond the scope of the study. There is, therefore, a proportion of the initial sample who did not return to the clinic whose treatment outcome is unclear. Telephonic interviews allowed the investigator to obtain an understanding of this group of patients that had not had further treatment after the initial contact. The analysis of their responses also clarifies patient perception better than the perusal of their clinical files. Clinical files do not contain a record of patient perception and opinions and telephonic interview were essential for obtaining a holistic idea of treatment.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

After analysing the quantitative and qualitative data the following was concluded

a. Patient history taking, examination and treatment record are inconsistent and poor for individuals rehabilitated with distal extension dentures,
b. Patient expectations of rehabilitation with mandibular distal extension dentures are largely unmet,
c. Patient dissatisfaction with mandibular distal extension RPDPs treatment is significant,
d. Clinicians are unaware of patient disappointment because not all patients return to the treatment centre to complain,
e. Patient awareness of the need to return for further management or correction of treatment failure following initial rehabilitation is low,
f. Certain individuals would be better managed by other treatment options like RPI, SDA, incorporation of implants with the RPDPs and implant fixed prosthesis,
g. The outcomes most commonly observed were:
    i. low frequency of wearing the prosthesis
    ii. high dissatisfaction with treatment,
    iii. remakes,
    iv. repair and
    v. abutment tooth extraction.

h. There was no statistically significant association between these outcomes and the Kennedy Classification, age or gender of participants, type of denture material, nature of opposing dentition, or number of recalls

7.2 Recommendations

From the above listed conclusions the following recommendations are made:

a. To improve vigilance by clinicians in patient history taking, examination and treatment record,
b. To implement digital backup of hard copy patient files could alleviate the problem of completely lost records,
c. To inquire about patient expectation concerning treatment and what they hope to gain from the prosthesis,
d. To ameliorate impossible expectations of mandibular RPDPs,
e. To teach undergraduate student to correctly identify clinical situations where RPDP rehabilitation is insufficient to improve function and aesthetics,
f. To educate patients concerning the need of improved oral care necessary to protect remaining teeth from loss following RPDP delivery and
g. To encourage patients to return to the treatment centre with any problems concerning the treatment and for periodic check-ups.

CHAPTER 8

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APPENDICES

APPENDIX 1: Patient Informed Consent and Information Form

I, Dr Joanna Y Chamoko am a qualified dentist carrying out research at the University of the Western Cape Faculty of Dentistry.

I am doing research on the outcomes of dentures/false teeth used to replace missing teeth in the lower jaws made by the University of the Western Cape. Please kindly supply your opinions concerning your lower jaw denture/false teeth by answering the questions that follow.

Participating in the study or answering the questionnaire is entirely voluntary. Refusal to take part will not prejudice or harm your treatment here, now or in the future in any way. If you would like to withdraw from the research at any future stage, please feel comfortable to inform us as such. Participating will assist the University to improve its denture/false teeth making process.

All information is strictly confidential and anonymous. You may ask any questions or air any further queries, comments and suggestions or if require any more information about this study to the researcher.

APPENDIX 2: Ethical Approval letter

Oral & Dental Research Institute
Faculty of Dentistry and WHO Oral Health Collaborating Centre
University of the Western Cape
Cape Town
11 April 2016

RE: ETHICAL APPROVAL OF MINI-THESIS

My name is Dr Joanna Y Chamoko. I am qualified dental practitioner that is currently studying Master of Science in Restorative/Clinical Dentistry with the University of the Western Cape's Faculty of Dentistry. I am applying for ethical clearance for my mini-thesis titled: Outcome of posterior mandible prosthetic rehabilitation with RPDPs.

Data collection for the thesis will involve the use of a questionnaire, patient dental records and dental technician laboratory records. The information gathered will be used to determine the success of dental prostheses. This evaluation will allow me to make recommendations towards the improvement of prostheses prognosis.

Patient participation is completely voluntary and patients may withdraw at any point during the study pull-out without any negative consequences. Anonymity will be insured by not including patient names on the data or questionnaire. A numbering system will be using to identify questionnaire and examination sheets.
Enclosed with this letter is the research protocol, the patient consent form, the patient information sheet and the questionnaire.

Yours Sincerely

Dr Joanna Yeukai Chamoko

APPENDIX 3: Data Collection form

Demographic	**Name/Questionnaire number**		
	File Number		
	Date of Birth/Age		
	Category		
	Gender		
	Contact number/email		
	Date of insertion/delivery		
Prosthesis	**Partial denture type**	Acrylic	Metal
	Kennedy Classification/division		
	Number of rests		
	Number of clasps		
	Type of clasps		
	Major connector		
	Special techniques in fabrication/ design	Undergraduate	postgraduate
	RPI		
	Altered cast technique		
	SDA		
	Precision attachments		
	Implant support		
	Immediate placement		
	Repairs		
	Relines		
	Recalls		
Status of natural dentition	**Opposing arch prosthesis/ teeth**		
	Extracted abutments		
	Restored abutments		
	Endodontically treated abutments		
	Number of mandibular teeth at delivery		
	Number of maxillary teeth at delivery		
	PI score at insertion		
	GI score at insertion		
Additional notes			

APPENDIX 4: Questionnaire

Questionnaire No#.....

Type of prosthesis……

Question					
How often do you wear the denture/false teeth made for you 5 years ago?	Not at all	Seldom	Often	Most of the time	All the time
Why have you not worn the denture/false teeth?					
Have you had the denture/false teeth replaced/changed?	Yes	No	No of times replaced/ changed:		When replaced/changed:
Why was the denture replaced?					
Have you had the denture/false teeth repaired in the last 5years?	Yes	No	No of times repaired:		
Is any part of the denture/false teeth broken or missing?	Yes	No			
Explain which part is broken?					
Describe the condition of the teeth the denture/false teeth clips onto	Painful/sensitive	Loose	Filled/ Crowned	Broken down	Root Canal /Extracted
Describe the condition of the teeth that oppose the denture/false teeth	Painful/sensitive	Loose	Filled/ Crowned	Broken down	Root Canal /Extracted
Have you seen a dentist since the denture/false teeth were placed?	Yes	No	Freq.		
Rate your satisfaction/happiness with the denture/false teeth on a scale of 1-10, 1= unhappy and 10= happy					
What feature has been most improved by the denture/ false teeth	Chewing	Appearance	Speech	Other	

Age: 60y
Sex: F
Delivery date: 11/06/2012
Design: KII, Acrylic, lingual plate, 2 clasp, 3 rests
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 10 teeth (33-47)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : Teeth were very uncomfortable, never wore it and threw it away
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: Broken done and some were extracted because they were breaking
8. Describe condition of teeth opposing the denture: The upper denture is loose. I cannot wear it without Coreaga. I am terrified to have another set made because the experience was traumatic
9. Have you seen a dentist since the denture/false teeth were made: Yes for fillings
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: scored 1
11. What feature has been most improved by the denture/false teeth: None

Age: 56y
Sex: F
Delivery date: 19/10/2011
Design: KII mod 1, CrCo, 2clasps, 3 rests
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 10 teeth(34-44, 46,48)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : The teeth were very sore. The metal wires darkened and looked ugly. The top felt bigger than my own teeth and I don't wear both top and bottom.
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: The teeth have fillings
8. Describe condition of teeth opposing the denture: Top teeth felt too big for my mouth
9. Have you seen a dentist since the denture/false teeth were made: Yes. I had fillings done.
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1 = unhappy and 10=happy: Scored 1
11. What feature has been most improved by the denture/false teeth: I can't chew

Age: 74y
Sex: F
Delivery date: 17/05/2012
Design: KII mod 1, CrCo,
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 9 teeth(34-44, 48)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : I cannot put it in. When I ate food with the denture food would get trapped underneath it and it was a hassle taking it out and rinsing it especially when I was out
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: they are fine
8. Describe condition of teeth opposing the denture: upper denture is fine
9. Have you seen a dentist since the denture/false teeth were made: No
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored 5
11. What feature has been most improved by the denture/false teeth: I cannot chew

Age: 61y
Sex: F
Delivery date: 10/10/ 2011
Design: KII mod 1, CrCo, 4rests, 2clasps
Opposing jaw: CrCo KII mod 2
Remaining mand teeth at time of delivery: 8 teeth(37-33, 43-45)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : The teeth were loose and painful
3. Have you had denture replaced/changed: Yes. It was remade thrice
4. Why was it replaced/changed?: Wasn't fitting well, it rocked and was loose
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: Yes, a wire broke while it being fitted
7. Describe condition of teeth denture clipped on: Two were extracted because they were biting into the upper plate causing it to rock
8. Describe condition of teeth opposing the denture: the upper plate was loose and was replaced
9. Have you seen a dentist since the denture/false teeth were made: Yes. For extractions and to make new teeth
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored 2
11. What feature has been most improved by the denture/false teeth: Could not chew with teeth

Age: 67
Sex: M
Delivery date: 22/09/2011
Design: KII mod 1, CrCo, 4rests, 3clasps, lingual plate
Opposing jaw: full upper plate
Remaining mand teeth at time of delivery: 9 teeth (37, 34-44)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : It was uncomfortable and painful. The wire on the left side broke and the teeth were loose
3. Have you had denture replaced/changed: Yes had teeth remade three times
4. Why was it replaced/changed?: They were uncomfortable. The 3rd set were made by a doctor not the students
5. Have you had denture repaired?: Yes. Was repaired a week after it was made
6. Is any part of denture broken/missing?: Yes. One wire broke
7. Describe condition of teeth denture clipped on: They are fine
8. Describe condition of teeth opposing the denture: No problems with my teeth
9. Have you seen a dentist since the denture/false teeth were made: Yes for cleaning and to have new teeth made
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 3
11. What feature has been most improved by the denture/false teeth: None

Age: 90
Sex: F
Delivery date: 03/06/2011
Design: KII mod 1, acrylic, not rests teeth crowned, 2clasps
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 5teeth
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : lower teeth were loose and they tightened the wire
3. Have you had denture replaced/changed: No. I requested new ones In 2014
4. Why was it replaced/changed?: No. I am on waiting list
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: Teeth have crowns
8. Describe condition of teeth opposing the denture: The upper teeth are also loose
9. Have you seen a dentist since the denture/false teeth were made: Yes. A tooth fell off the upper teeth
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 5
11. What feature has been most improved by the denture/false teeth: Chewing

Age: 76y
Sex: F
Delivery date: 28/08/2011
Design: KII mod 1, CrCo, lingual plate, 5rests, 2 clasps
Opposing jaw: KII mod 1
Remaining mand teeth at time of delivery: 7 teeth
Questionnaire responses

1. How often do you wear denture: Often
2. Why? : N/A
3. Have you had denture replaced/changed: Yes in 2015
4. Why was it replaced/changed?: The teeth didn't fit properly and I didn't like how they looked
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: Teeth are sensitive
8. Describe condition of teeth opposing the denture: Broken done and don't look nice
9. Have you seen a dentist since the denture/false teeth were made: Yes. I had some fillings done
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 6
11. What feature has been most improved by the denture/false teeth: improved chewing

Age: 76
Sex: F
Delivery date: 26/09/2011
Design: KI, CrCo, 4 rests and 2 clasps
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 5teeth (33-42)
Questionnaire responses

1. How often do you wear denture: All the time
2. Why haven't you worn them? : N/A
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: No
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: Good. I have no problems
8. Describe condition of teeth opposing the denture: Upper teeth fit well
9. Have you seen a dentist since the denture/false teeth were made: No
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 10
11. What feature has been most improved by the denture/false teeth: Chewing

Age: 86y
Sex: M
Delivery date: 17/05/2011
Design: KI, CrCo, lingual plate, 3 rests, 2 clasp
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 7 teeth (34-43)
Questionnaire responses

1. How often do you wear denture: All the time
2. Why have you not worn it? : N/A
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: No
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: The teeth are alright
8. Describe condition of teeth opposing the denture: the upper teeth fit well
9. Have you seen a dentist since the denture/false teeth were made: No, unable to move around or travel easily due to poor health
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 6-7
11. What feature has been most improved by the denture/false teeth: Helped a lot with chewing

Age: 75y
Sex: M
Delivery date: 08/05/2012
Design: KI mod 1, acrylic, lingual plate 4rests, 2 clasps
Opposing jaw: KII mod 1 acrylic
Remaining mand teeth at time of delivery: 9teeth (36, 34-45)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : I can't eat with the teeth. They are loose and just pop out on their own
3. Have you had denture replaced/changed: No but requested a new pair in 2014 and I am on waiting list
4. Why was it replaced/changed?: Can't chew with them
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: they are alright
8. Describe condition of teeth opposing the denture: upper plate doesn't fit well too
9. Have you seen a dentist since the denture/false teeth were made: I was called in to Tygerberg and had x-rays and pictures taken and still waiting for an appointment
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 1
11. What feature has been most improved by the denture/false teeth: I can't chew

Age: 67y
Sex: F
Delivery date: 05/10/2011
Design: KCl, CrCo
Opposing jaw: KIV
Remaining mand teeth at time of delivery: 9 teeth(45-34)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : The bottom one did not fit well at all and was very uncomfortable. I threw it away
3. Have you had denture replaced/changed: No but I would like a new set and I am on waiting list
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: 3 lower teeth were extracted before I began chemotherapy
8. Describe condition of teeth opposing the denture: I only have one tooth at the top. The rest were extracted for chemotherapy
9. Have you seen a dentist since the denture/false teeth were made: No
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 7
11. What feature has been most improved by the denture/false teeth: I am unable to chew

Age: 62y
Sex: F
Delivery date: 23/09/2011
Design: KI, CrCo, 3 rests, 2clasps
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 5 teeth (32-43)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : The teeth felt awkward and uncomfortable. I wear them when I go out for functions
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: those teeth are alright
8. Describe condition of teeth opposing the denture: the upper teeth were repaired when 2 top teeth fell off
9. Have you seen a dentist since the denture/false teeth were made: No
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 8
11. What feature has been most improved by the denture/false teeth: Improved my chewing

Age: 57y
Sex: F
Delivery date: 10/05/2012
Design: KI, CrCo, 3 rests, 2 clasps
Opposing jaw: KII mod 1
Remaining mand teeth at time of delivery: 7 teeth (34-43)
Questionnaire responses

1. How often do you wear denture: All the time except while sleeping
2. Why? : The teeth hurt and the pink part is worn exposing the metal that hurts. The set I had before which was also made at Tygerberg fit better than the current set
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: I would like a new set of teeth but I can't afford it
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: the tooth where the denture clips keeps falling out and has been replaced thrice
8. Describe condition of teeth opposing the denture: These are ok
9. Have you seen a dentist since the denture/false teeth were made: Yes I had a filling redone in May 2017
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 7
11. What feature has been most improved by the denture/false teeth: Helps me with chewing

Age: 78y
Sex: F
Delivery date: 25/04/2012
Design: KI, CrCo, 4 rests, 2 clasps, lingual bar
Opposing jaw: Dentate
Remaining mand teeth at time of delivery: 10 teeth (35-45)
Questionnaire responses

1. How often do you wear denture: Often
2. Why? : I wear it only when I am eating. When I eat with them food packs underneath my teeth because it doesn't fit well. I have to take it out to clean it every time I eat and I cannot do this especially when I go out
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: No
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: They are ok
8. Describe condition of teeth opposing the denture: those too are ok
9. Have you seen a dentist since the denture/false teeth were made: No
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 1
11. What feature has been most improved by the denture/false teeth: Helps with chewing

Age: 72y
Sex: F
Delivery date: 10/10/2011
Design: KI, Lingual bar, RPI, CrCo, 4rests, 2clasps,
Opposing jaw: KIII mod 2 CrCo
Remaining mand teeth at time of delivery: 10 teeth (35-45)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : The thing moved around a lot and hurt my gums. It was very uncomfortable and I never used it
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: worn down
8. Describe condition of teeth opposing the denture: These teeth are crowned and are fine
9. Have you seen a dentist since the denture/false teeth were made: Yes. The upper was remade after the teeth were crowned. The faculty is very far for me to travel
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 0
11. What feature has been most improved by the denture/false teeth: None. Doesn't use it

Age: 86y
Sex: F
Delivery date: 10/03/2011
Design: KI, CrCo, 3rests, 2clasps
Opposing jaw: partial denture
Remaining mand teeth at time of delivery: 8 teeth (34-44)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : The teeth are loose and I can't chew with them. I have been unhappy with these teeth since I got them
3. Have you had denture replaced/changed: No but I would like a new set
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: N/A
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: The teeth are ok
8. Describe condition of teeth opposing the denture: one crown became loose and had to be recemented
9. Have you seen a dentist since the denture/false teeth were made: Yes. For the cementation of the crown. I am on waiting list for new teeth
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: scored a 3
11. What feature has been most improved by the denture/false teeth: I can't chew

Age: 72y
Sex: F
Delivery date: 06/09/2011
Design: KI, CrCo, lingual bar, 3 rests, 2clasps
Opposing jaw: dentate with 13 teeth
Remaining mand teeth at time of delivery: 9teeth (34-45)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : The teeth are loose and uncomfortable. I can't eat or speak with them and they lift up when I speak or bite
3. Have you had denture replaced/changed: Yes. I had a new one made in 2013
4. Why was it replaced/changed?: I couldn't use the one before
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: There wasn't
7. Describe condition of teeth denture clipped on: the teeth are fine
8. Describe condition of teeth opposing the denture: have natural teeth that are alright
9. Have you seen a dentist since the denture/false teeth were made: yes to replace the denture
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: scored a 1
11. What feature has been most improved by the denture/false teeth: None. I couldn't chew or speak

Age: 81y
Sex: F
Delivery date: 14/06/2012
Design: KI, CrCo, 3 rests, 2clasps,
Opposing jaw: KI
Remaining mand teeth at time of delivery: 8teeth(34-44)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : the upper and lower denture do not bite together properly and cannot chew with them
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: I want a new set but I do not want to be seen by students anymore and I am waiting for an appointment
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: one of the clips is broken
7. Describe condition of teeth denture clipped on: the teeth have filings
8. Describe condition of teeth opposing the denture: I 3 remaining teeth at the top
9. Have you seen a dentist since the denture/false teeth were made: Yes twice for new sets of teeth but still on waiting list
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: scored a 1
11. What feature has been most improved by the denture/false teeth: None.

Age: 72y
Sex: F
Delivery date: 17/06/2011
Design: KI, CrCo, 3 rests, 2 clasps
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 7 teeth(33-44)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : Upper denture was loose and when I wore both the teeth felt too long or too big
3. Have you had denture replaced/changed: Yes in 2012
4. Why was it replaced/changed?: I couldn't use them or chew with them
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No there wasn't
7. Describe condition of teeth denture clipped on: the teeth are fine
8. Describe condition of teeth opposing the denture: upper teeth were too long or too big
9. Have you seen a dentist since the denture/false teeth were made: Yes, for replacement of teeth
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 1
11. What feature has been most improved by the denture/false teeth: Couldn't chew with them

Age: 57y
Sex: F
Delivery date: 15/06/2011
Design: KI, CrCo, 3rests, 2clasps
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 8 teeth (34-44)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : the bottom teeth were very uncomfortable and painful
3. Have you had denture replaced/changed: yes they were changed in 2o12
4. Why was it replaced/changed?: I couldn't chew with them and the upper were ugly
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: A clip of the bottom one broke
7. Describe condition of teeth denture clipped on: One of the teeth became loose and was removed
8. Describe condition of teeth opposing the denture: The teeth were ugly. I didn't like the colour and they were too big
9. Have you seen a dentist since the denture/false teeth were made: yes. I had a tooth puled at the bottom and a new set of teeth made
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: scored a 1
11. What feature has been most improved by the denture/false teeth: None

Age: 51y
Sex: M
Delivery date: 06/06/2012
Design: KII mod 2, CrCo, lingual plate, 3 rests, 3 clasps
Opposing jaw: KII mod 3
Remaining mand teeth at time of delivery: 10teeth(35-32, 41-45, 47)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : I am not able to use dentures because they are not biting properly
3. Have you had denture replaced/changed: Yes remade I in 2016
4. Why was it replaced/changed?: Couldn't use other set and was having difficulty chewing without teeth
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: last tooth(47) on right cutting my tongue, one had a filing(35) and the other an RCT(45)
8. Describe condition of teeth opposing the denture: teeth were not biting properly
9. Have you seen a dentist since the denture/false teeth were made: Yes, treatment as above
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: scored a 1
11. What feature has been most improved by the denture/false teeth: couldn't chew

Age: 85y
Sex: F
Delivery date: 05/06/2012
Design: KII mod 1, acrylic, lingual plate, 4 rests, 2 clasps
Opposing jaw: KII mod 1
Remaining mand teeth at time of delivery: 9 teeth (37, 34-44)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : I refused to wear them. I didn't like the top teeth because they were too big
3. Have you had denture replaced/changed: Yes
4. Why was it replaced/changed?: Made my face look long
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: the teeth are fine
8. Describe condition of teeth opposing the denture: these too are ok
9. Have you seen a dentist since the denture/false teeth were made: No
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 1
11. What feature has been most improved by the denture/false teeth: Didn't look right

Age: 53y
Sex: F
Delivery date: 19/09/2011
Design: KII mod 1, CrCo, 3 rests, 2 clasps
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 10 teeth (37, 34-45)
Questionnaire responses

1. How often do you wear denture: Often
2. Why? : bottom teeth were loose and uncomfortable
3. Have you had denture replaced/changed: Yes
4. Why was it replaced/changed?: The upper teeth fractured
5. Have you had denture repaired?: Yes the upper teeth were repaired
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: The teeth are ok
8. Describe condition of teeth opposing the denture: The upper broke twice
9. Have you seen a dentist since the denture/false teeth were made: yes for new set in 2013
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 6
11. What feature has been most improved by the denture/false teeth: Yes improved my chewing

Age: 58y
Sex: F
Delivery date: 29/09/2011
Design: KI, CrCo, lingual plate, 3 rests, 2 clasps
Opposing jaw: KII mod 1
Remaining mand teeth at time of delivery: 7 teeth (34-43)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : I wore it for 6 weeks and then stopped because it hurt my gums. I do not know where it is and I think I lost it
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: No
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: The teeth are alright
8. Describe condition of teeth opposing the denture: I have no problem with those too
9. Have you seen a dentist since the denture/false teeth were made: Yes in July 2017 I had cleaning done. I also had a pain in my jaw and was told they need to build up my denture
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: Scored a 1
11. What feature has been most improved by the denture/false teeth: Nothing

Age: 77y
Sex: F
Delivery date: 07/06/2011
Design: KI, acrylic, lingual plate, 2 rests, 2 clasps
Opposing jaw: KII mod 2
Remaining mand teeth at time of delivery: 7 teeth (33-44)
Questionnaire responses

1 How often do you wear denture: All the time
2. Why have you not worn it? : N/A
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: my teeth are fine
8. Describe condition of teeth opposing the denture: these are ok too
9. Have you seen a dentist since the denture/false teeth were made: Yes for cleaning in 2012, 2013 and 2014
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 7
11. What feature has been most improved by the denture/false teeth: Improved my chewing

Age: 57y
Sex: F
Delivery date: 17/06/2011
Design: KI, acrylic, lingual plate 4 rests, 2 clasps,
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 5teeth(31-44)
Questionnaire responses

1. How often do you wear denture: Most of the time
2. Why have you not worn it? : N/A
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: Yes twice it broke in the middle
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: the teeth are fine
8. Describe condition of teeth opposing the denture: The upper fits well
9. Have you seen a dentist since the denture/false teeth were made: Yes for repairs when it broke
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 6
11. What feature has been most improved by the denture/false teeth: Helps me to eat

Age: 69y
Sex: F
Delivery date: 19/06/2012
Design: KI, acrylic, lingual plate, 3 rests, 2 clasps immediate placement after extraction of 35, 34
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 7 teeth (33-44)
Questionnaire responses

1. How often do you wear denture: Most of the time
2. Why have you not worn it? : N/A
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: teeth are sensitive
8. Describe condition of teeth opposing the denture: Upper plate fits well
9. Have you seen a dentist since the denture/false teeth were made: Yes, I had cleaning done in 2015
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 8
11. What feature has been most improved by the denture/false teeth: Chewing

Age: 60y
Sex: M
Delivery date: 06/06/2012
Design: KII mod 2, acrylic, lingual plate, 3 rests, 2 clasps
Opposing jaw: Dentate
Remaining mand teeth at time of delivery: 5 teeth (36, 35, 43,44,46)
Questionnaire responses

1. How often do you wear denture: Most of the time
2. Why have you not worn it? : N/A
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: Teeth are loose or shaking
8. Describe condition of teeth opposing the denture: teeth are ok
9. Have you seen a dentist since the denture/false teeth were made: Yes I had three visits for cleaning in 2013
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 5
11. What feature has been most improved by the denture/false teeth: Yes, Chewing has improved

Age: 84y
Sex: F
Delivery date: 12/09/2012
Design: KII mod 1, CrCo, lingual plate, 4 rests, 3 clasps
Opposing jaw: Acrylic overdenture
Remaining mand teeth at time of delivery: 10teeth (38, 34-45)
Questionnaire responses

1. How often do you wear denture: Not at all
2. Why? : The teeth are uncomfortable and they hurt my gums. When I am chewing they rock
3. Have you had denture replaced/changed: No
4. Why was it replaced/changed?: N/A
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: the teeth have fillings
8. Describe condition of teeth opposing the denture: I feel heavy
9. Have you seen a dentist since the denture/false teeth were made: Yes for a review after they were made
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 2
11. What feature has been most improved by the denture/false teeth: yes chewing

Age: 66y
Sex: M
Delivery date: 18/04/2012
Design: KI, acrylic, lingual plate, 3 rests, 2 clasps
Opposing jaw: full upper denture
Remaining mand teeth at time of delivery: 7 teeth(34-43)
Questionnaire responses

1. How often do you wear denture: Seldom
2. Why? : After my teeth started breaking down to the gum and the plate become loose and didn't sit properly
3. Have you had denture replaced/changed: Yes. Had a new set made in 2014
4. Why was it replaced/changed?: The old ones didn't fit anymore
5. Have you had denture repaired?: No
6. Is any part of denture broken/missing?: No
7. Describe condition of teeth denture clipped on: Teeth decayed and broke down
8. Describe condition of teeth opposing the denture: I was loose would just fall down when I was talking
9. Have you seen a dentist since the denture/false teeth were made: Yes. I had all the bottom teeth removed and a new set of teeth made
10. Rate your satisfaction/happiness with denture/false teeth on a scale of 1-10, 1= unhappy and 10=happy: 4
11. What feature has been most improved by the denture/false teeth: Chewing