

**Effect of Different Designs of Bilateral Distal
Extension Removable Partial Dentures Retained
by Telescope Crowns on the Supporting
Structures**

Thesis

Submitted to the Faculty of Dentistry

Ain Shams University

**In partial fulfillment of the requirements for the
Doctor Degree in Oral and Maxillofacial Prosthodontics**

By

Rehab Helmy Abd El Fattah Ibrahim

B.D.S., Cairo University (1997)

M.D.S., Ain Shams University (2005)

Assoc. Lecturer, Prosthodontic Department

Faculty of Dentistry- Misr International University

Faculty of Dentistry

Ain Shams University

2011

Supervisors

Prof. Hany I. Eid

Professor of Prosthodontics

Faculty of Dentistry,

Ain Shams University

Prof. Fatma El-Zahraa A. Sayed

Professor of Prosthodontics

Faculty of Dentistry,

Ain Shams University

To

My gorgeous family,

My beloved husband,

My precious kids, Hana and Mohammed

Acknowledgement

First and foremost, thanks are due to Allah, the Beneficient and Merciful, by the grace of whom this work was possible.

I would like to express my deepest appreciation to Prof. Dr. Hany I. Eid, Professor of Prosthodontics, Faculty of Dentistry, Ain Shams University, who very kindly and generously gave much of his time and precious experience. Words stand short when expressing my gratefulness for his unlimited help, valuable guidance and instructions from the very beginning and throughout the whole work.

My great appreciation and thanks to Prof. Dr. Fatma El Zahraa A. Sayed, Professor of Prosthodontics, Faculty of Dentistry, Ain Shams University, for her kind supervision, faithful guidance and generous co-operation that made this work accomplished.

Last, but not least, I am very grateful to all the members of Prosthodontic Department, Misr International University for their kind co-operation and sincere help.

Contents

INTRODUCTION	1
REVIEW of LITERATURE	3
-Distal Extension Removable Partial Dentures	3
I. Designing support for distal extension bases	4
Load reduction	5
Load distribution	5
Role of impression in support	6
Mesial placement of occlusal rest	6
Implant placement	7
Improvement of residual ridge condition	7
II. Designing retention for distal extension bases	8
A. Direct retainers	8
1-Intracoronal retainers	9
2-Extracoronal retainers	9
a. Attachments	10
b. Clasp retainers	10
c. Telescopic retainers	11
-Types of telescopic retainers	12
-Advantages of telescopic retainers	16
-Disadvantages of telescopic retainers	17
-Telescopic retained partial denture versus	18
clasp	
retained partial denture	
-Splinting of abutment teeth	20
B. Indirect retainers	23

-Assessment of Removable Partial Denture Supporting Structures	25
I-Clinical Evaluation	26
II-Radiographic Evaluation	31
1. Film based radiography (Conventional radiography)	32
2. Digital radiography	35
AIM of THE STUDY	39
MATERIALS AND METHODS	40
RESULTS	60
DISCUSSION	79
SUMMARY	93
CONCLUSION	95
REFERENCES	96
ARABIC SUMMARY	

List of Figures

Fig. (1)	Lower bilateral distal extension base	44
Fig. (2)	Abutment preparation for group I patients	44
Fig. (3)	Abutment preparation for group II patients	44
Fig. (4)	Primary copings cemented on abutments for group I patients	45
Fig. (5)	Primary copings cemented on abutments for group II patients	45
Fig. (6)	Rubber base impression	46
Fig. (7)	Metal framework with cingulum rest as indirect retainer	47
Fig. (8)	Metal framework with double bilateral telescopic crowns	47
Fig. (9)	Try in of metal framework for group I patients	48
Fig. (10)	Try in of metal framework for group II patients	48
Fig. (11)	Selective pressure impression	50
Fig.(12)	Altered cast	50
Fig.(13)	Telescopic partial denture for Group I patients	52
Fig.(14)	Telescopic partial denture for Group II patients	52
Fig.(15)	Denture in patient's mouth	52
Fig.(16)	Radiographic template in the patient's mouth assembled to the film holder bite block.	56
Fig.(17)	Measuring marginal bone height mesial and distal to the abutment	58
Fig.(18)	Measuring the height of the distal extension edentulous ridge	58

Fig.(19)	Bar graph for the changes in pocket depth of abutments of group I and group II patients during follow up period	62
Fig.(20)	Bar graph for the changes in pocket depth of abutments of group I versus group II patients during the follow up period	64
Fig.(21)	Bar graph for the means of gingival index scores for group I and group II patients during the follow up period	66
Fig.(22)	Bar graph for the means of gingival index scores for group I versus group II patients during the follow up period	68
Fig.(23)	Bar graph for marginal bone loss of abutments of group I and group II patients during the follow up period	71
Fig.(24)	Bar graph for marginal bone loss of abutments of group I versus group II patients during the follow up period	73
Fig.(25)	Bar graph for crestal bone loss in group I and group II patients during the follow up period	76
Fig.(26)	Bar graph for crestal bone loss in group I versus group II patients during the follow up period	78

List of Tables

Table (1)	Means, Standard deviation values and results of ANOVA test for the means of change in pocket depth of abutments of dentures retained by bilateral TCs and cingulum rests (Group I) during the follow- up period.	61
Table (2)	Means, Standard deviation values and results of ANOVA test for the means of change in pocket depth of abutments of dentures retained by bilateral double TCs (Group II) during the follow up period.	62
Table (3)	Means, Standard deviation values and results of Student's t-test for the effect of group I and II designs on the change in means of pocket depth of abutments during the follow up period	63
Table (4)	Means, Standard deviation values and results of Friedman's test for the change by time in the means of gingival index score in patients having dentures retained by bilateral TCs and cingulum rests (Group I)	65
Table (5)	Means, Standard deviation values and results of Friedman's test for the change by time in the means of gingival index score in patients having dentures retained by bilateral double TCs (Group II).	66

Table (6)	Means, standard deviation values and results of Mann-Whitney U test for comparison between gingival index scores of patients in the two groups	67
Table (7)	Means, Standard deviation values and results of ANOVA test for marginal bone loss of abutments of dentures retained by bilateral TCs and cingulum rests (Group I)	70
Table (8)	Means, Standard deviation values and results of ANOVA test for marginal bone loss of abutments of dentures retained by bilateral double TCs (Group II)	71
Table (9)	Means, Standard deviation values and results of Student's t-test for comparison between means of marginal bone loss of abutments of the two groups	72
Table(10)	Means, Standard deviation values and results of ANOVA test for the crestal bone loss of dentures retained by bilateral TCs and cingulum rests (Group I)	75
Table(11)	Means, Standard deviation values and results of ANOVA test for the crestal bone loss of dentures retained by bilateral double TCs (Group II)	76
Table(12)	Means, Standard deviation values and results of Student's t-test for comparison between crestal bone loss in the two groups	77

List of abbreviations

RPD **Removable partial denture**

DEB **Distal extension base**

TCs **Telescopic crowns**

PD **Pocket depth**

GI **Gingival index**

Introduction

Preservation of supporting structures is of prime concern when restoring partially edentulous arches. Removable partial dentures (RPDs) should provide functional stability, good retention, an esthetic appearance and patient's comfort.⁽¹⁾

The difference in anatomy and physiology of natural teeth as well as their associated periodontal tissues and the residual ridges with their resilient mucoperiosteal covering makes it difficult to design tooth tissue supported partial dentures. This is due to the difference in response of the supporting tissues to wearing distal extension partial dentures.⁽²⁾

Studies proved that RPD design strongly affects the distribution of force between abutment teeth and the residual ridge.^(3, 4)

Lack of posterior retention in bilateral distal extension bases (DEBs) subjects the distal end of these bases to movement and rotation in an occlusal direction. This tends to move the denture out of ridge contact. Movement of DEBs should thus be prevented by designing direct retainers and indirect retainers.⁽⁵⁾

Many clinical studies were carried out on the effectiveness of RPD design. However, they were mainly focused on direct retainers and their effect on load transmission to the abutment teeth.⁽⁶⁻⁸⁾

The selection of retainers suitable for distal extension RPDs and the concept of connecting the denture with the

remaining teeth are key factors in the preservation of abutment teeth and the long term success of RPDs. ^{(9) (10)}

Retainers are selected according to several factors including number, alignment and periodontal status of the remaining teeth. Also, the esthetic demands and financial limitations of the patient are considerable factors. ⁽⁹⁾

Forces that produce torque on abutment teeth should be controlled and minimized when designing RPDs. Various stress controlling clasp designs have been designed for retaining DEBs. ⁽¹¹⁻¹³⁾ Although clasp retained partial dentures are commonly used in dental practice, the attachment retained and telescopic partial dentures are increasingly used as acceptable treatment modalities. ⁽¹²⁻¹⁵⁾

Telescopic crowns (TCs) were reported as effective retainers for DEBs as they provide support, controlled retention and splinting action. They also transfer forces along the long axes of abutment teeth. ⁽¹⁶⁻¹⁸⁾ It was also reported that TCs provide indirect retention. It is thus apparent to assess whether telescopic dentures need an addition of an indirect retainer or to comply with a simpler design depending on indirect retention provided by the TCs.

To weigh the merits of various RPD designs several lines of treatment must be studied to evaluate their effect on supporting structures. ⁽¹¹⁾ Hence, this study was proposed to assess the effect of different telescopic denture designs on the RPD supporting structures.

Review of Literature

Distal Extension Removable Partial Dentures

Distal extension partial dentures are defined as "Removable partial dentures supported and retained by natural teeth at one end of the denture base and in which portion of the functional load is carried by the residual ridge." ⁽¹⁹⁾

Bilateral DEBs are the most common clinical condition among partially edentulous patients, hence, they were classified by Kennedy as class I cases. DEBs occur more frequently in the lower jaw compared to the upper jaw. ⁽²⁰⁾

Several problems are usually encountered in designing DEBs. These problems are mainly related to the support and retention of the dentures.

The current perio-prosthodontic literature indicates that the greatest potential for destructive forces on the teeth and their periodontal supporting apparatus as well as on the residual ridges occurs when the patient is treated with distal extension RPDs. ⁽²⁾

The forces transmitted to a removable prosthesis can be widely distributed, directed and minimized by selection of the design and location of components of the RPD and by development of harmonious occlusion. ⁽²¹⁾

I-Designing support for distal extension bases

Distal extension partial denture depends on the residual ridge for portion of its support due to lack of posterior teeth support. Maintaining support from the residual ridge is required as the distance from the last abutment increases.⁽²¹⁾

Residual ridge tissues are 20-25 times more resilient compared to the periodontal attachment apparatus of abutment teeth. Hence, under vertical load RPD tends to rotate around a fulcrum line that coincides with its most distal occlusal rest. This results in bone resorption and torque on the abutment teeth. Torque effect increases if the clasp tip is placed mesial to the axis of rotation comparable to class I lever.^(22, 10)

In an invitro study, it was proved that placing the retentive component on the side of the fulcrum line away from the extension base causes movement of the abutment tooth in an undesirable occlusal direction.⁽²³⁾

The influence of wearing dentures on the residual ridge was investigated. The results indicated that wearing dentures reduced the height of the residual ridge due to a slow progressive process of bone resorption.⁽²⁴⁾

The edentulous ridge of free end saddle cases usually bears part of the masticatory load; hence, ridge resorption is likely to occur. At the same time the abutment tooth is subjected to torque in both antero-posterior and buccolingual directions

resulting in premature breakdown of the supporting bony tissues.
(20)

Adequate support for DEBs could be achieved by:

Load reduction

Reduction of the size of occlusal table of artificial teeth reduces forces and stresses on the abutment teeth and supporting tissues. (20)

Reduction of the functional load can be achieved by broad base coverage resulting in less load per unit area and better support. (21)

Splinting abutment teeth can also enhance support by distribution of functional load to teeth adjacent to abutments. This also reduces destructive stresses within the periodontium of abutments. (25)

Load distribution

Distributing stresses to as many remaining teeth as possible is achieved by placement of rests and clasping teeth. However, opponents to this concept mentioned that during function the denture rotates around the fulcrum line and the anteriorly placed components are disengaged reducing their effectiveness. Also, additional coverage of remaining teeth would be conducive to caries. (26)