

## EVALUATION OF THE RETENTION IN THE THERMOPLASTIC ACETAL RESIN DISTAL EXTENSION PARTIAL DENTURE PROSTHESIS WITH DIFFERENT DENTURE BASE EXTENSIONS

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### **ABSTRACT**

**Objectives:** The present study was conducted to investigate the retention and the patient satisfaction of the Thermoplastic Acetal resin distal extension partial denture prosthesis with different denture base extension length either extended to covered the retro molar pad or extended just at the anterior border of the retro molar pad in unmodified Kennedy class II mandibular cases. Thermoplastic Acetal resin partial denture is more comfortable and can replace any number of teeth in a dental arch.

**Methods:** Total number of ten healthy patients with unmodified Kennedy class II mandibular cases were selected and received extra coronal attachment on the experimental side, and received unilateral partial denture with thermoplastic Acetal resin framework. The patients were grouped into two groups. Group I received mandibular unilateral distal (without denture base extension) just end at the anterior border of the retro molar pad and group II received mandibular unilateral distal (with denture base extension) covered the retromolar pad. Then the retention evaluation and patient satisfaction was done at insertion of dentures, six months and after 12 months from the insertion.

**Results:** For both groups regarding the retention evaluation, there was insignificant difference between both groups as P-value > 0.05. Regarding the patient satisfaction Group I (without denture base extension) showed statistically significantly higher mean satisfaction score than Group II.

**Conclusions:** The patients who received mandibular unilateral distal (without denture base extension) were more satisfied by the prosthesis, and regarding the retention there was no significant difference between both groups so the unilateral partial denture with thermoplastic Acetal resin framework without denture base extension is more preferable.

**KEYWORDS:** Distal extension Removable partial denture, Thermoplastic Acetal resin framework.

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## INTRODUCTION

The problems of distal extension base cases are mainly due to the absence of the posterior abutment and the difference in resiliency between the periodontal ligament of the abutment teeth and the mucoperiosteum covering the edentulous ridge. This causes the denture base tend to rotate around the fulcrum line under loading, thereby exerting excessive torque on the abutment teeth which could lead to their early loss.<sup>(1-4)</sup>

Osseointegrated implants considered one of the best treatment modalities that provide prosthesis for unilateral distal extension base cases. Even a single implant placed in a strategic position But, Even though they provide successful outcomes and superior biomechanical qualities, there was certain limitation may contraindicate the uses of implants.<sup>(5)</sup>

Various design concepts were suggested to solve the problems of unilateral distal extension base cases. The conventional removable partial denture mainly associated with such as increased gingivitis, periodontitis, and abutment mobility. And that mainly need to crossing the dental arch to achieve cross arch stabilization .which causes more discomfort to the patient. Unilateral restorations that do not cross the other side of the arch are considered for this reason optimal treatment for unilateral distal extension base cases.<sup>(6-9)</sup>

Extra coronal attachments were also successfully used in unilateral distal extension base cases since they provide good esthetics, retention, and favorable distribution of stresses to the abutment teeth. They are also well tolerated by the patient and they are easy to maintain and clean.<sup>(10-11)</sup>

OT unilateral attachments have multiple advantages as they provide lateral stability, no milling required, superior retention and controlled resiliency. The design of the OT unilateral attachment features two in one combination of 1.8 mm horizontal and vertical spheres utilizing OT

cap and OT strategy micro size female caps. The male section of the attachment is engineered with a vertical strut which extends through the base of the attachment giving exceptional lateral stability and distal support to the prosthesis.<sup>(12,13)</sup>

A thermoplastic Acetal resin is a biocompatible material so can use with patient allergic to Co-Cr alloys and have good physical properties make it suitable for construction of removable partial dentures<sup>(14-16)</sup>. It is reported to have a sufficiently high resilience and modulus of elasticity to allow its use in the manufacture of retentive clasps<sup>(17-19)</sup>, connectors, and support elements for removable partial denture. Also, Acetal resin is also strong, resists fracturing, and is flexible so, does not wear during occlusal forces and consequently will maintain vertical dimension Over long periods of time<sup>(20-22)</sup>.

The present study aims to compare clinically the retention and patient satisfaction of using thermoplastic Acetal resin as a partial denture frame work with extension to covered the retro molar pad and without extension of the denture base and end at the anterior border of the retro molar pad (it just beyond the last replaced artificial molar).

## MATERIALS AND METHODS

- **Patient selection:** Ten female patients were selected from the outpatient clinic Prosthodontics Department, Faculty of oral and dental Medicine, Cairo University, their ages ranged from 40 to 55 years. All patients were partially edentulous had unmodified mandibular Kennedy class II with the second premolar being the last abutment on the experimental side showing sufficient occluso-gingival height of its clinical crown. Intact opposing arch without noticeable over eruption or tilting. Only patients restored with acceptable fixed restoration were included in the study. Showing sufficient inter-arch space. The remaining natural teeth had

apparently good periodontal condition with no signs of inflammation, mobility and adequate bone support. Only patients who can be easily motivated to achieve and maintain good oral hygiene were selected.

#### Prosthetic treatment:

- The lower first and second premolars on the experimental side were prepared with a deep chamfer finishing line extend sub-gingivally (0.5-1mm) with sufficient occlusal (2-2.5mm) and circumferential reduction (1-1.5mm) to receive two full porcelain veneered crowns.
- Gingival margin of the prepared abutments were retracted by retraction cord\* before impression making.

Finally putty impression\*\* was made The light body rubber base impression material. Metal try-in of the crowns-attachment assembly was carried-out intra-orally, and final cementation of the crown-attachment assembly was done. Thermoplastic Acetal\*\*\* resin framework construction and jaw relation records were obtained respectively. Group I patients received partial dentures retained with the

OT extra coronal attachment (without distal denture base extension) end the denture base at the anterior border of the retro-molar pad beyond the second molar. **Figure (1)**

Group II patients received partial dentures retained with the OT extra coronal attachment (with distal denture base extension) extend the denture base to covered the retro molar pad. **Figure(2)**

A wrought wire 1mm in diameter was adjusted to form a loop and fixed by self cure acrylic resin in a corresponding hole made occlusally between the first and second molars to allow reattaching the wire at the same position during testing the retention at different time intervals throughout the study.

#### Figure (3)

#### Retention measurement:

The most common type of force meter used is the digital force meter. it works through attachment to the tested denture and it records the tension needed to dislodge the denture from its place. The measurements can be recorded either by Newton.

#### Figure (4)



Fig. (1) Denture base extended just to the anterior border of the retro molar pad.



Fig. (2) Denture base covering the retro molar pad.

\* Gingivet, Dentsply, Latin America.

\*\*Zetaplus, Zermack, Italy.

\*\*\* Thermoflex; Austenal, Inc, pen, USA.



Fig. (3) A wrought wire loop fixed by self cure acrylic resin

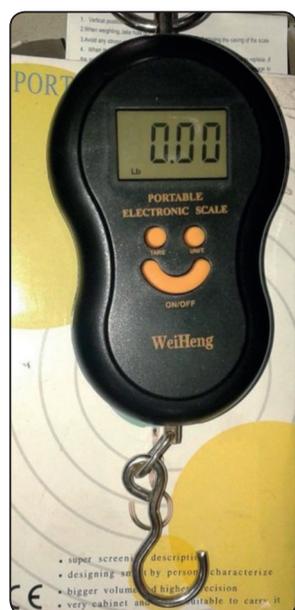


Fig. (4) portable electronic scale force meter .

In this study, retention of the lower removable partial denture was examined and measured by the digital force-meter, using Acetal resin removable partial denture with different denture base extension group I (without distal denture base extension), group II (with distal denture base extension covered the retromolar pad ).

The in vitro studies use several methods such as pulling, lever arm arrangement and the force meter. Pulling is done by using; pullies, springs, universal testing machine or force meter.<sup>(23-27)</sup>

In this study the retention was measured at the time of insertion , 6 months and after 12 month.

In between the reading of the retention the wire loop was removed.

**Patient satisfaction measurement:** Patient satisfaction was evaluated by means of a questionnaire developed in consideration of the most important aspects used to evaluate the prosthesis which are esthetics, function, retention, stability and comfort

## RESULTS

### Retention Measurements:

Measurements of retention values were taken for both groups using digital forcimeter and mean and standard deviation were calculated for further statistical study along three follow up periods (at delivery, six months and after twelve months).

At delivery, group I (without distal extension) showed mean and standard deviation of retention values ( $0.069 \pm 0.0296$ ) while for group II (with distal extension) were ( $0.0714 \pm 0.004$ ), as listed in table (1).

After six months, group I (without distal extension) showed mean and standard deviation of retention values ( $0.046 \pm 0.021$ ) while for group II (with distal extension) were ( $0.0573 \pm 0.097$ ), as listed in table (1).

After twelve months, group I (without distal extension) showed mean and standard deviation of retention values ( $0.032 \pm 0.012$ ) while for group II (with distal extension) were ( $0.039 \pm 0.081$ ), as listed in table (1).

For evaluation of effect of time on retention values in each group, one-way analysis of variance (ANOVA) was performed followed by Tukey`s post hoc test for multiple comparisons. It was revealed that there was insignificant differences between all-time intervals in each group as P-value > 0.05, listed in table (1) and showed in figure ( 5).

Performing independent t test for comparison between both groups at all follow up periods, there was insignificant difference between both groups as P-value > 0.05, as listed in table (1) and showed in figure ( 5).

TABLE (1): Mean and standard deviation of retention values for both groups:

		Group I (Without Distal Extension)	Group II (With Distal Extension)	P-value
Retention (N)	At Delivery	0.069±0.0296 <sup>a</sup>	0.0714±0.004 <sup>a</sup>	0.8485*
	6 Months	0.046±0.021 <sup>a</sup>	0.0573±0.097 <sup>a</sup>	0.8055*
	12 Months	0.032±0.012 <sup>a</sup>	0.039±0.081 <sup>a</sup>	0.8532*
	P-value	0.063*	0.7854*	

M; Mean, SD; Standard deviation, P; Probability Level  
\*insignificant difference



Fig. (5): Bar chart revealing retention values for both groups

**Visual Analogue Scale:**

During this study, Ten patients divided randomly and equally into two groups and asked frequently about their dentures regarding many parameters listed in table (2). For the ease of evaluation, the scales were listed as a visual analogue scale from 0 to 10 for further statistical analysis.

Using independent t-test, it was revealed that there was a significant agreement on group II (with distal extension) as P-value < 0.05 except for esthetics which was absolute insignificant difference between both groups as P-value > 0.05, listed in table (2) and showed in figure ( 6).

TABLE (2): Distribution of visual analogue scale on denture parameters as means and standard deviations:

Parameters	Group I (Without Distal Extension)	Group II (With Distal Extension)	P-value
Esthetics	8±2.1	8±1.6	Absolute Insignificance
Function	6±0.44	8±1.8	0.0145**
Retention	7±0.31	9±0.27	0.0001**
Stability	7±0.8	9±0.13	0.0001**
Comfort	6±0.75	9±0.84	0.0001**

N; Number, M; Mean, SD; Standard Deviation

\*\*significant difference

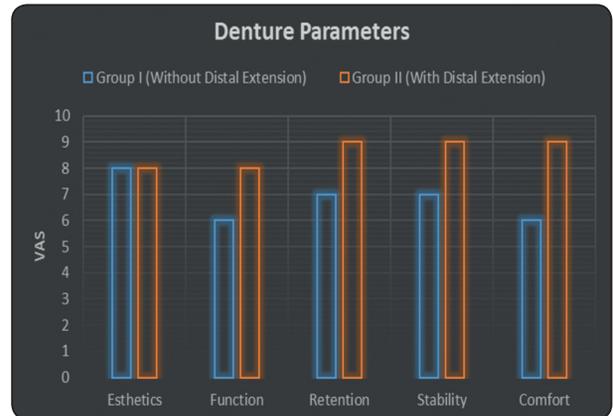


Fig. (6): Bar chart revealing VAS for both groups

**DISCUSSION**

The present study was conducted on ten partially edentulous female Patients ranged from 40-50 years, to avoid the variations in the female hormonal condition<sup>(28-29)</sup>. it was reported that estrogen withdrawal in post- menopausal women

is associated with progressive decrease in the bone density the edentulous ridges.

All cases, had normal morphology and proper ridge height were covered with healthy firm mucosa, since ridge contour and the nature of mucosal coverage are important factor help in favorable stress distribution to the supporting structures and help in denture stability and patient more satisfied with the successful prosthetic treatment.

Sufficient occluso-gingival height of abutment crown was effectively offset the leverage forces exerted on the crown and Adequate inter-arch space was essential To accommodate attachment(the 4mm height,2 mm for the artificial resin tooth and 1mm space beneath the attachment was left and inter-occlusal space that is not less than 7mm was mandatory for proper oral hygiene)

The opposing maxillary arches were either dentulous or partially edentulous restored with fixed restoration(s), to standardize the amount of occlusal force applied to the lower arch,<sup>(30,31)</sup> Patients with super-eruption maxillary posterior teeth opposing the edentulous areas were corrected to allow for establishment of a reasonable occlusal plane and harmonious occlusion.<sup>(32)</sup>

A major concern with the use of a distal extension prosthesis is the control of excessive torquing forces so, abutment distal wall evaluation is of concern to study the effect of RPD on abutment teeth<sup>(13)</sup>

Acetal resin is a biocompatible material so can use with patient allergic to Co-Cr alloys and have good physical properties make it suitable for construction of removable partial dentures.

Also, Acetal resin has a sufficiently high resilience and modulus of elasticity allow it to engage the undercut of the residue ridge and its flexibility help it to be adaptable , more comfortable to the patient .

Acetal resin is also strong and resists Fracturing so it does not wear under the occlusal forces and it will maintain vertical dimension over long periods

of time.All this criteria makes it an ideal material for single unilateral partial dentures.<sup>(33)</sup>

Regarding Retention, at the time of insertion and after six months : group I (without distal denture base extension) was showed mean and standard deviation of retention values less than group II (with distal extension) .while after twelve month, there was insignificant difference between both groups group I (without distal denture base extension) and group II (with distal denture base extension covered the retromolar pad ), this fact may attributed to the criteria of the Acetal resin as it has high resilience, modulus of elasticity , strong and flexibility so the denture base extension was not affected significantly on the retention .

Regarding patient satisfaction, the patient's opinion plays an important role in evaluating the successful of the prosthesis .Group I showed statistically significantly higher mean satisfaction score than Group II.

So, This results give indication about the retention was not affected by the extension of the denture base and the patients Group I was satisfied by the prosthesis without extension of the denture base.

## REFERENCES

- 1- Phoenix RD, Cagna DR and 5-Defreest CF: Stewart's clinical removable partial prosthodontics. 3~ed. Quintessence publishing co. China 2003; 103-110, 45, 352-355, 53-126, 240-242, 237.
- 2- Holmes JB: Influence of impression procedures and occlusal loading on partial denture movement. J. Prosthet. Dent. 2001; 86: 335.
- 3- McGivney GP and Carr AB: Removable partial prosthodontics. 10<sup>th</sup> ed. Mosby co. ,ST. Louis, 2000; pp.25-32 , 338-339, 73-189,121.
- 4- Arce-Tumbay, J., Sanchez-Ayala, A., Sotto-Maior, B.S., Senna, P. M. & Campanha, N. H.: Mastication in subjects with extremely shortened dental arches rehabilitated with removable partial dentures. Int. J. Prosthodont. 2011;24, 517-9

- 5- Kreinmer G, Krainhofner M, Waldenberger O and Piehslinger E: Dental implant and strategic supplementary abutment for implant tooth supported telescopic crown retained maxillary dentures: A retrospective follow-up study for up-to 9 years. *Int. J. Prosthodont.* 2007; 20: 617.
- 6- Dos Santos Nunes Reis, J. M., Da Cruz Perez, L. E., Alfenas, B. F. M., De Oliveira Abi-Rached, F. & Filho, J. N. A. Maxillary Rehabilitation Using Fixed and Removable Partial Dentures with Attachments: A Clinical Report. *Journal of Prosthodont.* 2014; 23, 58–63.
- 7- Ashish R jain ,Jacoba M Philip and Padma A: Attachment-retained unilateral Distal Extension (Kennedy's class II modification I) Cast partial Denture. *J. Prosthet. Dent.* 2012; 2(3):101-107.
- 8- Bambara GE: Precision and semiprecision attachments in dentistry. *Contemp. Esthet. Dent.* 2012; 575-581.
- 9- Ku, Y. C., Shen, Y. F. & Chan, C. P. Extracoronary resilient attachments in distal-extension removable partial dentures. *Quintessence Int.* 2003; 1, 311–7 .
- 10- Hedzelek W, Rzafrvsk S and Czarnicka B: Evaluation of retentive characteristics of semi-precision extra-coral attachment. *J. Oral Rehab.* 2011; 38 : 4062.
- 11- Preiskel HW. Precision : Attachment in prosthodontics. 1&2. London: Quintessence publishing Co Ltd 1995.
- 12- Rhein 83@srl, Catalogue/Technical manual for dentists and dental technicians: Attachments and prefabricated castable components, 2005; pp.8-10, 46-48.
- 13- Schmitt, J., Wichmann, M., Eitner, S., Hamel, J. & Holst, S. :Five-year Clinical Follow-up of Prefabricated Precision Attachments: a Comparison of Uni- and Bilateral Removable Dental Prostheses. *Quintessence Int.* 2011; 42, 413–8 .
- 14- Macura-Karbownik, A., Chladek, G., Żmudzki, J. & Kasperski, J. :Chewing efficiency and occlusal forces in PMMA, acetal and polyamide removable partial denture wearers. *Acta Bioeng. Biomech.* 2016; 18, 127–134 .
- 15- Negruțiu M, Sinescu C, Sandu Liliana: Guidelines of removable partial dentures. Ed. Marineasa Timișoara, 2004.
- 16- Lowe LG :Flexible denture flanges for patients exhibiting undercut tuberosities and reduced width of the buccal vestibule: a clinical report. *J Prosthet Dent.* 2011; 92: 128-131.
- 17- Keenan PL, Radford DR, Clark RK :Dimensional change in complete dentures fabricated by injection molding and microwave processing. *J Prosthet Dent.* 2003; 89: 37-44.
- 18- Negruțiu M, Sinescu C, Romanu M, Pop D, Lakatos S : Thermoplastic Resins for Flexible Framework Removable Partial Dentures. *TMJ.* 2005; 55: 295-99.
- 19- Prafulla Thumati, Padmaja S, Raghavendra Reddy K :Flexible Dentures in Prosthodontics - An overview *Indian J Dent.* 2013; 5(4): 1380-1385
- 20- Arda T, Arıkan A: An in vitro comparison of retentive force and deformation of acetal resin and cobalt–chromium clasps. *J Prosthet Dent.* 2005; 94: 267–74.
- 21- John J, Gangadhar SA, Shah I: Flexural strength of heat polymerized polymethyl methacrylate denture resin reinforced with glass, aramid or nylon fibers. *J Prosthet Dent* 2001; 86(4):424-7
- 22- Negruțiu M., Sinescu C., Rominu M., Pop D., Lakatos S: Thermoplastic resins for flexible framework removable partial dentures. *Timisoara Medical Journal*, 2005; Vol. 55. No. 3, pp. 295-299
- 23- Churygin SN: Comparative analysis of the results of patient prosthetic treatment by removable arch and elastic constructions in cases of end mandibular defects based on microcirculation study of the prosthetic bed tissues. *Stomatologia (Mosk)* .2007; 86(5):58-61.
- 24- Antonelli JR, Hottel TL: The flexible augmented flange technique for fabricating complete denture record bases. *Quintessence Int* .2001; 35(5):361-4.
- 25- Parvizi A, Lindquist T, Schneider R, Williamson D, Boyer D, Dawson DV: Comparison of the dimensional accuracy of injection molded base materials to that of conventional pressure pack acrylic resin. *J. Prosthodont* .2004; 13(2): 13-9.
- 26- Lai YL, Lai HF, Lee SY: In vitro color stability, strain resistance and water sorption of four removable gingival flange materials. *J. Prosthet Dent* .2003; 90(30):293-300.
- 27- Lowe LG: Flexible denture flange for patients exhibiting undercut tuberosities and reduced width of the buccal vestibule: a clinical report. *J. Prosthet Dent.* 2004; 92(2):128-31.
- 28- Von Womern N and Kollerup G. :Symptomatic osteoporosis – a risk factor for residual ridge reduction of the jaw. *J .Prosthet. Dent.* 1992; 67:656-660.

- 29- August M, Chung K, Chang Y, Glowacki J. : Influence of estrogen status on endosseous implants integration". J Oral Maxillofac Surg. 2001; 59: 1280-1285.
- 30- Spondang P., Kungai H , Tanaka E , Ozaki H, Nikawa H, Tanne K and Hamada T :Correlation between maximum bite force and craniofacial morphology of young adults in Indonesia . J. Oral Rehabil. 2003; 30(11):1109-1117 .
- 31- Krishna Prasad D., Rajendra Prasad B., Anshul Bardia and A nupama Parsad D. Enhancing Stability :A Review of various occlusal schemes in complete denture prosthesis. 2013; NUJHS Vol.3, No. 2, ISSN 2249-7110.
- 32- Fahmy A, Abuelroos EM, Nada MM. :Effect of using attachment on implant supported distal extension lower partial over dentures. Cairo Dent J.2008; 24:11-18.
- 33- Saad El-Din M, Gebreel A, Swedan MM: Thermoplastic Distal Extension Removable Partial Dentures versus Vitallium ones -Radiographic Evaluation Mansoura Journal of Dentistry 2014;1(3):20-23.