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EVALUATION OF DIGITAL OCCLUSAL ANALYSIS AND ELECTRO-MYOGRAPHIC ACTIVITY OF DIFFERENT DESIGNS OF EXTRA-CORONAL CASTABLE PRECISION ATTACHMENT OF UNILATERAL MANDIBULAR DISTAL EXTENSION AREA COMPARATIVE RANDOMIZED CLINICAL TRAIL

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ABSTRACT

Purpose: The aim of this study was to evaluate the occlusal load (using T-scan system) and electromyography of patients with unilateral mandibular distal extension area treated with three designs of the removable partial denture (RPD), conventional RPD. RPD retained by OT unilateral extra coronal attachment and RPD retained by OT cap extra coronal attachment.

Material and Methods: With the last second premolar serving as a permanent abutment tooth, eighteen Kennedy class II partially edentulous individuals were chosen. Three groups of six patients each were formed from the patients. Group I: was given conventional RPD, which provides cross arch stabilization with a double Aker clasp on the unmodified side was fabricated. Group II; Received unilateral RPD held by (O T) unilateral extra-coronal attachment, Group III; Received RPD held, by (O T) cap extra-coronal attachment with bilateral cross arch stabilization. Assessment of occlusal load done by using T-scanner (Digital occlusal analysis) and EMG activity done by (Electromyographic recording machine), patients of three groups were evaluated at the time of prosthesis insertion, then after 3and 6 months.

Results: In the digital occlusal analysis, comparison between the three groups at the baseline, after 3 and 6 months, the better results were obtained and showed a statistically significant increase in Group II (OT unilateral), especially after 3, 6 months.

Conclusion: From the results of this study, it was concluded that: The extra coronal castable precision attachment (OT unilateral) is preferred over traditional RPD and OT cap extra coronal attachment because it is easier to use, more pleasant for patients, and provides superior occlusal load distribution and better electromyographic activity.

KEY WORDS; T-scan system, OT Unilateral, Removable Partial Denture

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INTRODUCTION

Unilateral distal extension causes discrepancies in support between the hard and soft tissues, which causes the prosthesis to shift and has an adverse impact on the bone and surrounding tissues. Because the periodontal ligaments of abutment teeth and the mucosa supporting dentures have different levels of resilience, Vertical forces will unevenly transfer to the tissues they are investing in when they are applied.[1].

Kennedy's Class I & II cases can make it difficult to restore a partially edentulous arch because patients frequently use removable partial dentures (RPDs) to replace missing teeth and increase their masticatory performance. Although some patients with mandibular RPDs complain of disability or functional limits that make everyday life challenging, patient comfort is essential. [2].

The best option for treatment in this circumstance is a combination prosthesis such as a removable partial denture held with attachment, which can be thought of as an alternative to implants but is not indicated due to limited bone and financial considerations. [3]

To provide retention and stability, a variety of extra-coronal attachments are routinely used in combination prostheses. Attachment retained RPD is regarded as a successful method that makes it possible to restore lost teeth and oral tissues in a way that is both aesthetically pleasing and functional. Since extra-coronal attachments offer good aesthetics, retention, and a favorable stress distribution to the abutment teeth, they were too effectively used in unilateral distal extension base instances. Additionally, the patient tolerates them well, and they are simple to maintain and clean. [4, 5]

Removable partial dentures built with precise attachments that enhance both mechanical and aesthetic performance. A connector with precision attachment contains two components. The male component is attached to a tooth, implant, or root, and the female component is built into the prosthesis to provide a mechanical connection between both [6].

Extra-coronal attachments are ideal for partial dentures with long edentulous spans, non-parallel abutments, and short clinical crowns. Splinting natural abutments near to the free end saddle is also advised to aid in stress distribution. Fixed splinting of the final abutment teeth with crowns will be crucial, especially if the prosthesis has a long lever arm that places an excessive amount of torque on the abutment teeth. [7].

When a resilient prosthesis is required, the OT unilateral extra coronal resilient attachment system provides perpendicular resiliency and all-purpose stress alleviation. These attachments' retention of RPD offers aesthetics, vertical resiliency, and simple replacement of damaged attachments. [8].

There are many levels of resilience in the OT-CAP attachment. Castable extra-coronal OT-CAP attachments have proven to be an effective treatment modality for partially edentulous cases. The stresses that are transmitted to the abutments are controlled by the design of the retentive elements. Additionally, retention at the sphere's equator is produced by the elastic memory of the titanium "male." Over time, the titanium spring's incorporation into nylon also improves functionality. [9, 10].

According to several studies, the primary risk of causing localized destruction to the remaining teeth and their supportive structures is the main disadvantage of removable partial dentures. Increased plaque collection, caries, periodontal disease, resorption of the residual ridge supporting the partial denture, and an uneven distribution of occlusal pressures are the main causes of this. [11, 12]

One of the newest digital techniques that uses an intraoral pressure-mapping sensor to analyze occlusal forces is known as the T-Scan System. Which uses qualitative data to modify quantitative

data over a preset time period in a digital realm to provide correction of unbalanced forces in each segment as well as evaluation of the quantifiable aspects of occlusal contact forces. A big benefit is that the practitioner's subjective interpretations are gone. [13, 14]. n this study, three alternative designs of removable partial dentures were used to treat patients with unilateral mandibular distal extension area in order to assess occlusal load (using the T-Scan System) and electromyographic activity.

MATERIAL AND METHODS

Selection of participants

Following the inclusion criteria for our study, eighteen partially edentulous male patients from the Outpatient Clinic of the Prosthodontic Department, Faculty of Dental Medicine for Girls , Al-Azhar University, were chosen. Their ages ranged from (40-45) years. Patients with unilateral mandibular distal extension area with the last remaining abutments that exhibit adequate occluso-gingival height of its clinical crown are the second premolars. Full opposing dentate arch or restored with suitable fixed prosthesis. Edentulous ridge without an aberrant bone irregularity or a severe lingual undercut, covered by a healthy, firm mucoperiosteum. The abutment teeth appeared to be in good periodontal health; there were no signs of inflammation or movement, and there was no tissue undercut. Patients with the bony undercuts, lingual tori, shallow mouth floors, and lingually tilted teeth were all rejected. Sufficient interarch space, and no problems with the tempromandibular joint. There shouldn't have been any parafunctional habits, such as bruxism, in the patient's past. All patients appeared to be in generally good health and were free of systemic conditions like diabetes mellitus.. We only chose patients who have a strong motivation to attain and maintain proper dental hygiene. The research ethics committee approved this study.

Prosthetic preparation

Using alginate impression material (Cavex, impression material, Holland), a preliminary impression was taken of the maxillary and mandibular arches. The mounted study casts were then evaluated for occl usion, inter- occlusal distance, any teeth interference, and the condition of the outstanding teeth before the fabrication of special trays.

Group I:

The design of group 1 uses the lingual bar major connection, which is held in place by a embrasure clasp on the dentate side, and a gingival approaching clasp (RPI), on the last abutment tooth (second premolar) on the edentulous side, to stabilize the prosthesis by crossing the arch. The canine on the edentulous side of the mouth has the cingulum rest, which serves as an indirect retainer, and the embrasure clasp was placed on the first and second molars. Natural teeth were prepared, and rubber base impression material (Zetaplus / Oranwash L, Zhermack, Rovigo, Italy) was used on a customized tray to obtain the final impression. The imprint was poured into dental stone (Dental stone manufacture hard stone, Spain) to make a master cast, then it was surveyed. The refractory cast was created by altering the master cast and duplicating it. Wax patterns of the RPD framework were constructed on the refractory cast in accordance with the original design. For the distal extension area, an altered cast impression was obtained. The impression-carrying framework was properly repositioned on the cast. The relationship between the metal framework and its cast was fixed using sticky wax. The edentulous ridge section was then filled with improved stone once the secondary impression had been beaded, boxed, and finished. The maxillary cast was mounted on a semi-adjustable articulator utilizing a face bow record made using a maxillary face bow (Corident, Korea). The wax (Cavex, modeling wax, Holland) wafer method was used to record the centric occlusion relation. Anatomical cross-linked acrylic teeth were set up (Vita, acrylic teeth,

German) and tried in the patient's mouth before the RPD was flasked, processed, de-flasked, and finished Co-Cr RPD was delivered to all patients, occlusal load distribution and EMG activity were measured at one, three and six months respectively.

Group II&III:

First and second premolars on the free end saddle were reduced for both groups in order to make room for porcelain fused metal crowns. Rubber base impression material were used to take the secondary impressions for the reduced teeth, which were then poured to secondary casts. The dies of the cast, which were placed on the milling machine's surface, were used to create the wax patterns for both crowns.

The male portion of the attachment was attached to the distal surface of the last abutment tooth in both groups using a parallel-meter, perpendicular to the underlying ridge and about 1mm above the residual ridge. To make room for the lingual bracing arm, a ledge was created on the lingual surface of the second premolar's wax pattern. The metal crown attachment units were tried in intraorally in both groups after the final wax pattern of the union was invested and cast. (Fig1)

Group II, in this design, impression of the porcelain crown-attachment structure was taken then definite prosthesis with the female component of the attachment was processed, finished and polished. Finally, each patient was received side plate removable partial denture retained by OT Unilateral attachment. (Fig2)

Group III, this design has lingual bar major connector retained by double aker clasp at the non-

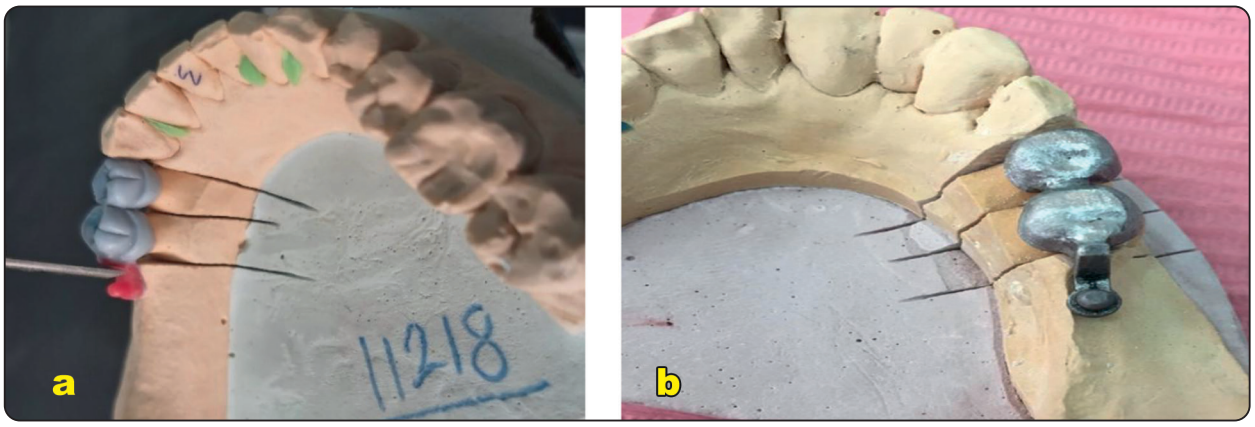

Fig. (1): Wax pattern (a) and metal try in (b) of the crown-unilateral attachment unit.

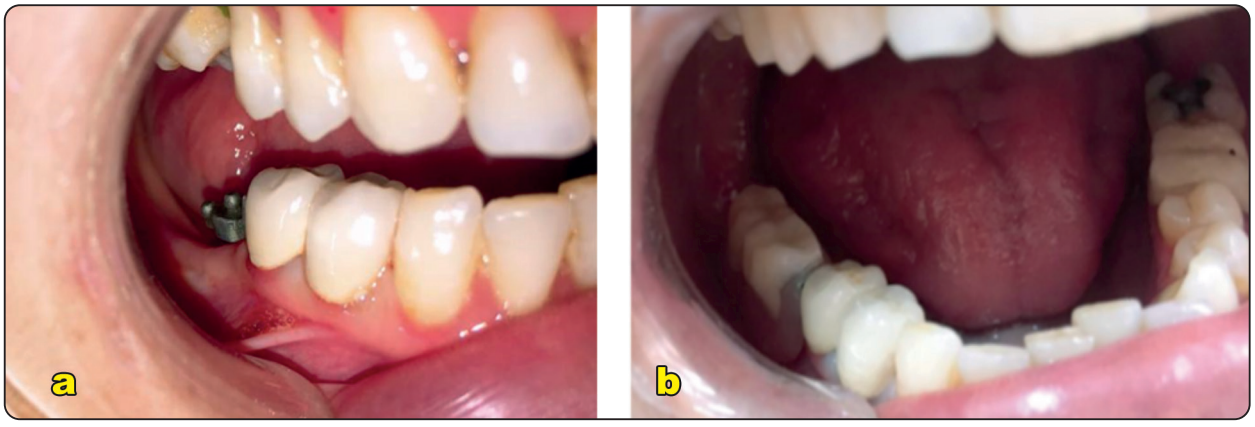

Fig. (2): (a) Crown attachment assembly. (b) Final prosthesis retained by OT-unilateral attachment.

modified side to provide cross arch stabilization of the RPD by crossing the midline. This was done as follow, preparation of 2nd premolar to receive distal and mesial rest seats on 1st molar to accommodate embrasure clasp, indirect retention gained by preparation of mesial rest seat on1st premolar for the terminal end of lingual bar, final porcelain crowns-attachment unite was tried in intraorally after selection of proper porcelain shade for each patient.

Impression of the porcelain crown-attachment structure was taken. Cast modification and duplication were performed to produce a duplicate cast from refractory material. The duplicate cast was waxed for RPD framework in group III as the last design.

Try-in the metal framework was carried out in patient's mouth to check proper seating and passive path of insertion and removal, then altered cast impression was made, centric relation was recorded then setting up artificial teeth, try in, processing and finishing of the prosthesis were done. (Fig3).

All patients were given rigorous oral hygiene instructions and called back a week after delivery to address any issues that may have surfaced during the initial prosthesis adaptation phase.

Patient evaluation:

All patients were evaluated clinically at the time of denture insertion, three and six months after denture delivery.

Fig. (3): Final prosthesis of RPD retained by OT Cap castable precision attachment.

Digital occlusal analysis:

The T-scanner (T scan system) is a computerized system that is used for digital occlusal analysis. This system is made up of a computer with a specialized board and software that can record the data and transformed it by the sensor into visual and numerical information on each tooth contact.

For the T-scan system to operate correctly, the computer system must fulfil or exceed the required system specifications. The T-scan USB handle can be connected to a computer without the need for an additional interface card or parallel box. The operating system of the computer will instantly recognize and set up the hardware for use when it is installed. The patient's occlusal characteristics were sensed by the T-Scan sensor, which was an extremely thin and flexible printed circuit. (Fig 4).

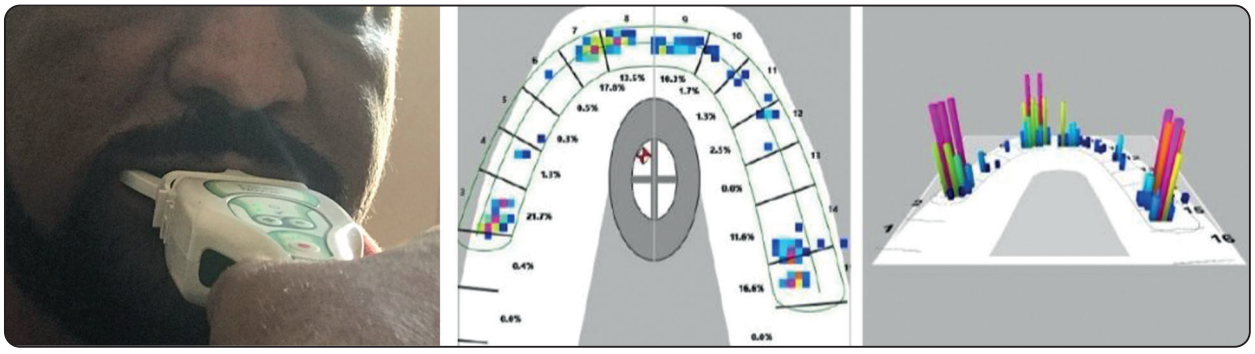

Fig. (4): Digital occlusal analysis records (T scan records).

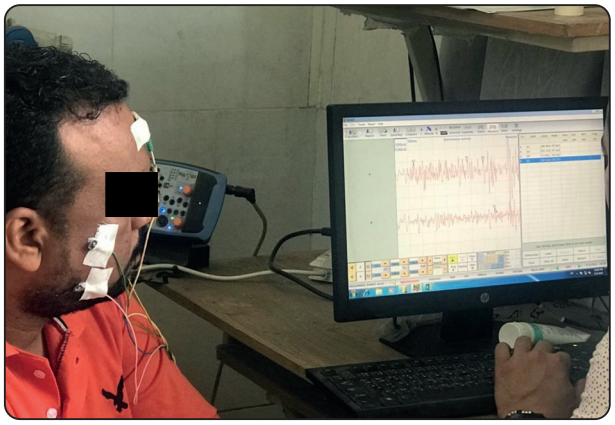

Fig. (5): EMG activity measurements

Electromyographic activity

The Electromyographic (EMG) activity was recorded for each patient by EMG recording machine. The EMG activity was performed by measuring muscle activity of the masseter and anterior temporalis muscles on both sides using electromyography with two types of test foods (carrot as hard food, and banana as soft food) During all recording, the patients were seated with their head unsupported and were asked to maintain a naturally erect position.

STATISTICAL ANALYSIS:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Performing one-way analysis of variance (ANOVA). The confidence interval was set to 95% So, the p-value was considered significant as P-value $\leq$0.05.

RESULTS

Occlusal load analysis in all groups was at the time of insertion 39.73±4.79**,**52.63±2.49**,** and 49.57±2.84, while after 3months was 42.60±4.31,60.67±2.50, and 56.50±2.26, and after 6 months was 47.17±4.90, 64.67±3.53, and 59.63±2.36 respectively. Comparison was performed between all groups using repetitive One Way ANOVA which revealed significant difference in mean (P<0.05) at time of denture insertion and after 3 and 6 months as showed in table (1) and figure (1).

Occlusal load analysis in Group I was 39.73±4.79, 42.60±4.31 and 47.17±4.90 at time of denture insertion, after 3 and 6 months respectively. One-way ANOVA revealed that there is a significant difference between all follow-up periods as p< 0.05. Table (1).

Occlusal load analysis in Group II was 52.63±2.49, 60.67±2.50 and 64.67 ± 3.53 at time of insertion, after 3 and 6 months respectively. One-way ANOVA revealed that there is a significant difference between all follow-up periods as p < 0.05. Table (1).

Occlusal load analysis in Group III was 49.57±2.84, 56.50±2.26 and 59.63±2.36 at time of insertion, after 3 and 6 months respectively. One-way ANOVA showed that there is a significant difference between all follow-up periods as p< 0.05. Table (1).

EMG activity of masseter and temporalis muscles for patients with removable partial denture (RPD), conventional RPD, OT Unilateral extra coronal attachment and OT cap extra coronal attachment during clenching, soft and hard food:

The statistical analysis of the obtained data from EMG results for of masseter and temporalis muscles for patients with removable partial denture (RPD), conventional RPD, OT Unilateral extra coronal attachment and OT cap extra coronal attachment during clenching, soft and hard food on preformed silicon index at different time intervals (at insertion, 1 month, and 3 months) were tabulated in (Table 2.3).

The results of this study compare between conventional RPD, OT Unilateral extra coronal attachment and OT cap extra coronal attachment according to EMG signals (mean± SD) values of masseter and temporalis muscles during clenching on preformed silicon index, during eating soft food and during eating hard food after at insertion, 1 month, and 3 months later showed statistically significant difference for masseter and temporalis muscles as indicated by two-way ANOVA (Table 2, 3)

TABLE (1) Mean and standard deviation of occlusal load analysis in the three groups at insertion after 3months and 6 months:

		Conventional Co-Cr RPD	RPD retained by OT unilateral	RPD retained by OT- Cap	Test value•	P- value	Sig.
		No.= 6	No.= 6	No.= 6			
At insertion time	Mean±SD	39.73 ± 4.79	52.63 ± 2.49	49.57 ± 2.84	21.988	0.000	HS
At 3 months	Mean±SD	42.60 ± 4.31	60.67 ± 2.50	56.50 ± 2.26	53.829	0.000	HS
At 6 months	Mean±SD	47.17 ± 4.90	64.67 ± 3.53	59.63 ± 2.36	34.746	0.000	HS

P- value < 0.05: Significant (S); P- value < 0.01: highly significant (HS) ***•: One Way ANOVA test***

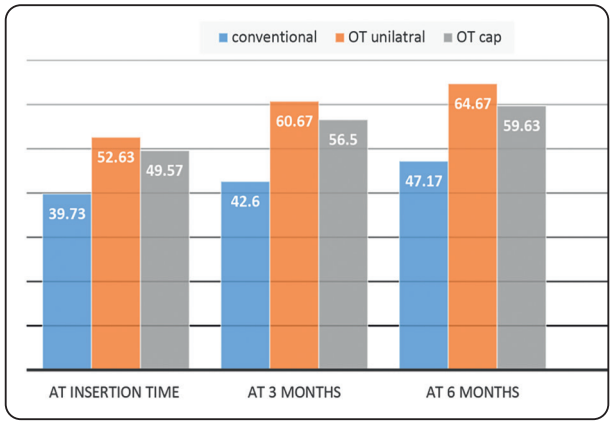

Fig. (6) Occlusal load analysis at insertion after 3, 6 months:

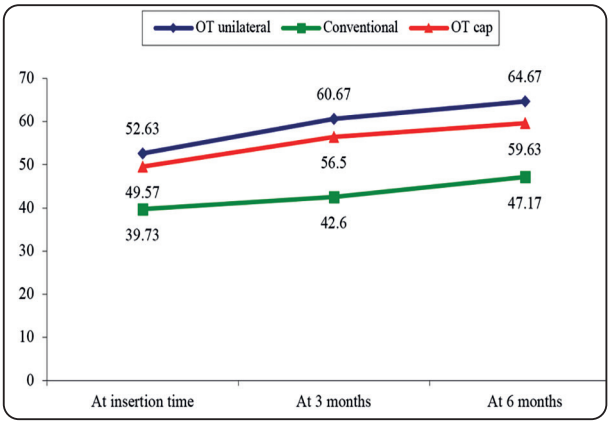

Fig. (7) Line chart representing mean of three groups at different time periods

TABLE (2) EMG activity of masseter muscle for patients with RPD at different follow-up periods in all studied groups.

Electromyographic activity	Conventional group No. = 6	OT Unilateral group No. = 6	OT CAP group No. = 6	Test value•	P-value	Sig.
Masseter muscle soft food						
At insertion time						
Right	48.78 ± 2.98	87.15 ± 4.99	52.06 ± 2.51	203.068	0.000	HS
Left	48.72 ± 1.27	58.89 ± 2.29	61.34 ± 2.71	56.770	0.000	HS
Average	48.75 ± 2.07	73.02 ± 3.28	56.70 ± 2.45	131.021	0.000	HS
3 months						
Right	51.34 ± 3.63	89.65 ± 5.64	56.00 ± 4.59	118.955	0.000	HS
Left	51.04 ± 2.08	61.06 ± 2.48	64.25 ± 3.21	41.112	0.000	HS
Average	51.19 ± 2.76	75.35 ± 3.71	60.12 ± 3.34	82.549	0.000	HS
6 months						
Right	53.44 ± 4.02	92.41 ± 5.03	59.40 ± 4.20	134.178	0.000	HS
Left	53.58 ± 2.60	63.48 ± 2.64	67.65 ± 2.69	44.856	0.000	HS
Average	53.51 ± 3.17	77.94 ± 3.31	63.53 ± 2.98	90.807	0.000	HS

Electromyographic activity	Conventional group No. = 6	OT Unilateral group No. = 6	OT CAP group No. = 6	Test value•	P-value	Sig.
Masseter muscle Hard food						
At insertion time						
Right	123.59 ± 3.77	219.28 ± 4.65	156.84 ± 4.33	778.319	0.000	HS
Left	115.48 ± 3.35	222.47 ± 2.71	136.03 ± 5.10	1300.703	0.000	HS
Average	119.53 ± 2.53	220.87 ± 2.96	146.44 ± 4.61	1360.712	0.000	HS
3 months						
Right	125.98 ± 3.68	221.98 ± 5.28	159.91 ± 4.28	714.631	0.000	HS
Left	118.54 ± 2.95	224.96 ± 3.04	138.91 ± 5.00	1335.526	0.000	HS
Average	122.26 ± 2.70	223.47 ± 3.50	149.41 ± 4.58	1219.755	0.000	HS
6 months						
Right	129.82 ± 4.14	225.98 ± 5.76	164.57 ± 3.95	647.751	0.000	HS
Left	123.54 ± 3.23	229.69 ± 3.65	143.41 ± 4.68	1255.781	0.000	HS
Average	126.68 ± 3.07	227.84 ± 4.12	153.99 ± 4.19	1121.718	0.000	HS

P- value < 0.05: Significant (S); P- value < 0.01: highly significant (HS) ***•: One Way ANOVA test***

TABLE (3) EMG activity of temporalis muscle for patients with RPD at different follow-up periods in all studied groups.

Electromyography activity		Conventional group No. = 6	OT Unilateral group No. = 6	OT CAP group No. = 6	Test value•	P-value	Sig.
Temporalis soft food							
At insertion time							
Right	Mean ± SD	41.32 ± 1.64	47.95 ± 1.85	54.98 ± 2.84	59.173	0.000	HS
Left	Mean ± SD	37.08 ± 1.70	52.19 ± 2.49	44.42 ± 2.93	58.142	0.000	HS
Average	Mean ± SD	39.20 ± 0.51	50.07 ± 2.11	49.70 ± 2.68	57.637	0.000	HS
3 months							
Right	Mean ± SD	44.37 ± 1.74	50.01 ± 2.28	57.23 ± 2.34	54.632	0.000	HS
Left	Mean ± SD	39.25 ± 1.77	54.53 ± 2.37	47.33 ± 1.60	93.165	0.000	HS
Average	Mean ± SD	41.81 ± 0.74	52.27 ± 2.18	52.28 ± 1.58	84.575	0.000	HS
6 months							
Right	Mean ± SD	48.43 ± 2.08	54.79 ± 2.56	62.23 ± 3.35	38.908	0.000	HS
Left	Mean ± SD	43.60 ± 1.81	58.92 ± 1.77	52.00 ± 2.60	80.307	0.000	HS
Average	Mean ± SD	46.02 ± 0.85	56.86 ± 2.04	57.11 ± 2.32	70.638	0.000	HS
Temporalis hard food							
At insertion time							
Right	Mean ± SD	101.23 ± 4.30	192.14 ± 1.84	118.56 ± 2.61	1460.809	0.000	HS
Left	Mean ± SD	96.79 ± 7.28	175.09 ± 3.19	111.25 ± 2.90	436.623	0.000	HS
Average	Mean ± SD	99.01 ± 5.20	183.61 ± 2.47	114.90 ± 2.20	959.318	0.000	HS
3 months							
Right	Mean ± SD	103.70 ± 4.56	194.76 ± 1.58	120.86 ± 3.25	1246.052	0.000	HS
Left	Mean ± SD	98.76 ± 7.17	177.25 ± 2.97	113.76 ± 3.45	433.045	0.000	HS
Average	Mean ± SD	101.23 ± 5.08	186.01 ± 2.20	117.31 ± 3.03	915.770	0.000	HS
6 months							
Right	Mean ± SD	107.99 ± 4.68	199.58 ± 1.68	124.13 ± 0.00	1743.385	0.000	HS
Left	Mean ± SD	104.32 ± 7.45	182.21 ± 2.97	116.68 ± 0.00	490.035	0.000	HS
Average	Mean ± SD	106.15 ± 5.29	190.89 ± 2.24	120.41 ± 0.00	1122.969	0.000	HS

P- value >0.05: P- value <0.05: Significant (S); P-value < 0.01: highly significant (HS) ***•: One Way ANOVA test***

DISCUSSION

In the selected patients, the maxillary arch was either partially edentulous or dentulous restored with fixed prosthesis for controlling the effect of antagonistic occlusion and consequent effect on applied force distribution. The selected patients did not suffer from any chronic diseases which may have an effect on the outcomes of this study as the medical questionnaire indicated. Furthermore, patients having Class II or Class III ridge relation, clenching and any disorders of TMJ were removed, to withdraw their effect on chewing forces that may lead to excessive residual alveolar ridge resorption or inaccurate analysis of occlusal load. [15]

Only male patients were selected for this study to dodge the effects of the female hormonal variation on alveolar bone, and oral mucosa. Moreover, the maximum bite force of men is generally higher than of women as men usually have longer jaw dimensions. To add more, the bite force of men is directly proportional to the diameter and the cross-sectional area of the masseter muscles. [16]

In this study restoration of unilateral distal extension cases was done by association between fixed and RPD by attachments alternative to a conventional clasp-retained RPD; by using two different extra coronal attachments (OT unilateral and OT CAP extra coronal attachments) which considered treatment modalities for enhancing the retention in Kennedy class II cases [17].

Precision attachment has appeared to be one of the most unique criteria of removable prosthesis as it improves the aesthetics; it terminates the metal clasps display, decreases post-operative adjustments, enhances the patient comfort and overcomes the disadvantages of (RPD) [18].

On the experimental side, the last abutment teeth was splinted by porcelain fused to metal crown; positioning the attachment at the center in bucco-lingual dimension with minimal tilting lingually is significant for esthetics, and fair stress distribution on attachment-prosthesis structure during wax pattern construction of crowns-attachment assembly, resulting in enhanced support and improved prognosis of RPD [19-20].

T-scan system was used as a diagnostic tool as it has high sensitivity and unique usage as it shows greater reliability and consistency, even in the presence of saliva intraorally, that's why it was used in performing the computerized occlusal analysis. Moreover, the T-scan system uses recording sensor of about 100 mm thick to overcome the problems related to the thickness of the occlusal registration materials. In addition, T-Scan quantifies the amount of relative occlusal force to initially identify areas of uniform occlusion and assist the clinician to ensure homogenous occlusal force distribution., however, articulating paper, which is used to be the most popular conventional method to detect any discrepancies of occlusion clinically, is impossible to carry out the same process with. T-scan was proved to be very accurate, reliable, and easily repeatable in this study and many other studies. [21,22]

Occlusal load analysis is considered a parameter indicating the masticatory system function, our results in this study displayed a significant increase in all groups with time from baseline to 6 months' follow up. The higher occlusal load was recorded when baseline compared to 6 months in all groups. This is because, it may be refered to the gradual accommodation and adaptation by patients to the new RPD. This was in agreement other studies results, which concluded that, patients usually use their prosthesis much better after sometime, regardless of the type of RPD [23].

After statistical analysis of results, group II (patient wearing OT unilateral attachment) showed higher significant than group I (patient wearing conventional RPD and group III (patient wearing OT cap attachment) at insertion and after 3,6 months, this might be because of the unique design

of the attachment (OT Unilateral) as , its elasticity, in addition to both heads being present in 2 diverse levels at both planes (horizontal and vertical). That assists fair distribution of stresses applied, better under masticatory forces and elevates RPD stability and retention, also enhance the biting force with retentive RPD which have a great role in patient comfort [24].

The results of this study was in line with recent researches as, OT unilateral attachment displays minimum response on the abutments supporting structures because there was no need for extending the prosthesis across the arch that add the favor of not needing to prepare more abutment teeth, decreasing the thickness of the prosthesis in the oral cavity, thus minimizing the coverage of both areas (soft and hard tissue) opposing OT cap attachment which gain its stability by crossing the arch. So the percentage of bone loss was higher than the unilateral design, and the supporting structure state is in better condition talking of OT unilateral attachment [9].

Generally, the simpler the design of the RPD, the better the outcome. To elaborate more, every component RPD is made of must only be essential; if not, it must be removed. Taking this into consideration, Group II [unilateral design] proved itself to be better than both Group I [conventional design] and Group III [bilateral design] ; as after 3 then after 6 months, it showed statistically significantly higher occlusal load distribution, the resiliency and unique design of the OT Unilateral extra-coronal attachment had the upper hand in showing these results, Placing double balls in diverse planes facilitates the load distribution evenly under chewing force and provide maximum usage of both OT unilateral and OT cap in one elastic modality. [25]

Using unilateral precision attachment displayed an increase in prosthesis retention, stability, and comfort. Hence, these factors aid the achievement of better neuromuscular coordination, which improved the masticatory performance more than the conventional RPD, as they needed no effort to stabilize or retain the RPD, this agrees with Heckman et al [26]

The state of the maxillary arch, either it is dentate or partially edentulous restored by fixed restoration, is considered the main significant factor that control and regulate the amount of the forces transmitted to the mandibular arch. In treatment of restoring mandibular free end saddle, any possible extrusion or tilting of the opposing teeth was aligned and corrected, to create harmonious occlusion in both centric and eccentric jaw relations, and to control any lateral stresses falling in the remaining natural teeth. [27]

Introducing the unilateral extra coronal attachment made it available to restore free end saddle areas with no need to the cross arch extension. Sravanthi [28] proved that the RPD support and its connection with fixed restoration generate cross arch stabilization during mastication and gives function almost similar to that of fixed prosthesis. All attachment designs reduce the display of metal, so the esthetics are improved. For a successful clinical outcome, it should be optimally positioned and in harmony with the insertion path of the outlined RPD. To add more, extra coronal castable attachments have elastic retention, as a result, the shock-absorbing prosthesis and the flexure can be controlled. [29, 30]

The Masticatory muscles activity is represented by masseter and anterior temporalis muscles as not only they are the strongest and largest muscles but they also have accessibility during recording, in addition, they have a significant role in mandibular movement. To fend off the diversity in the activity of the recorded muscles, the records collected and the mean was calculated bilaterally at each interval of follow up period, [31, 32]

The surface EMG offered a noninvasive technique to record the elevator muscles activity, specifically the masseter and anterior temporalis

muscles, to add more, signal detection and processing by these technological advances have boosted the qualification of the data collected from the surface EMG, although it did have some limitations; shape, size of an electrode, and exact determination of the location for signal recording. [33]

In the current research, it was recorded the improvements in masticatory activity and EMG readings along the follow up period after adjustment of the last denture to investigate the time as factor on EMG recording up to 6 months in patients who received RPD with discrete designs, this agrees with Garrett et al [33] who stated that to adapt to a new denture, more than 3 months of function with RPD is needed. [33, 34]

According to these results, OT unilateral extra coronal attachment provided higher occlusal load distribution than the OT cap extra coronal attachment and conventional groups after 3, and 6 months. This may be because loss of function of some of the occlusal contact areas, which caused patients to stroke and chew for a longer time to make the tested food able to be swallowed. This finding agrees with the results of many recent studies. [35, 36]

In our evaluation of occlusal load distribution, we assume that EMG recorded muscular activity during chewing soft food (banana) and hard food (carrot) was highly related to masticatory activity. These results don't match with those of Fueki et al.[37], However, this conclusion agrees with the results of Felicio et al.[38], who suggested that the masticatory efficiency test was positively correlated to the EMG activities of jaw closing muscle. So, further studies of RPD wearers are needed to illustrate the association between EMG activity, masticatory efficiency and occlusal load distribution.

CONCLUSION

Using OT unilateral extra coronal castable precision attachment in retaining RPD is preferable as it appears to be simpler, more tolerated by patients, and provide better occlusal load distribution and EMJ activity than conventional RPD and RPD retained by OT cap extra coronal attachment. In addition to, these prosthetics can unite the benefits of both removable and fixed prosthesis.

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