

CLINICAL EVALUATION OF READY MADE POST VERSUS CUSTOM MADE POST IN MANDIBULAR TOOTH SUPPORTED OVERDENTURE (A RANDOMIZED CLINICAL TRIAL)

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ABSTRACT

Aim: This study aimed to evaluate the retention and patient satisfaction outcomes in ready made posts versus custom made posts in mandibular tooth supported overdenture .

Settings and Design: A randomized clinical trial at faculty of dentistry, Cairo University.

Materials and Methods: This study was conducted on twelve patients with bilateral mandibular single rooted teeth; canines , first or second premolars. they were divided into two groups each of six patients. **Group A** (study group) received ready made posts bilaterally. **Group B** (control group) received custom made posts bilaterally . The retention was evaluated by the digital Force meter. However the patient satisfaction outcomes was evaluated by tailored chart of questions as regards difficulty in chewing and stability.

Results: A statistically significant difference($P < 0.05$) were found between both groups ready made post and custom made post at 1m and 3m in both retention and patient satisfaction outcomes however no statistically significant difference ($P > 0.05$) were found after 6m for both groups.

Conclusion: The results of this study revealed that custom made posts revealed a better retention values and patient satisfaction outcomes than the ready made posts.

KEYWORDS: Ready made post, custom made post, retention values, patient satisfaction, mandibular implant tooth supported overdenture.

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INTRODUCTION

The prosthodontic treatment is aiming not only for the replacement of missing teeth but also for the preservation of the surrounding supporting and remaining structures .⁽¹⁾

Clinically, different prosthodontic options are available for the rehabilitation of partially and completely edentulous patients as the use of dental implants, fixed prosthesis, removable partial or complete dentures which differ according to the clinical situation.

Overdentures also offers an alternative treatment modality which is efficient in certain clinical situations. ^(2,3).

The prosthetic rehabilitation using teeth supported overdenture are indicated in cases in which the teeth may be indicated for extraction.^(4,5,6,7).

The preservation of teeth in strategic position is an efficient way that can improve the final prognosis regarding stability and retention of the overdenture prosthesis particularly in cases of moderate and poor ridge foundation , preserve the proprioceptive response of the periodontal ligament which decrease the possibility of bone resorption. It also improves the patient satisfaction outcomes by the feeling of more retention and security.^(8,9,10).

Ready-made post of tooth supported overdenture is widely used nowadays for ease of handling, more time consuming, acceptable results, cost effectiveness and adequate clinical serviceability for both patient and prosthodontics.

The prognosis of teeth supported overdenture depend mainly on the periodontal condition of the abutment tooth, which is represented as the health of the alveolar bone together with periodontal and gingival attachment. The masticatory stresses also is a very critical factor in cases of tooth supported overdenture which are less the in completely edentulous patient. The stresses generated should be equalized by the strain produced from the support of overdenture abutment. ⁽¹⁴⁾

Lindhe and Svanberg, Caputo and Standlee demonstrated the principle and mechanism of food mastication and distribution ,they reported that the occlusal stresses have certain adverse effect on the teeth, supporting alveolar bone, and periodontal ligament manifested as loss of alveolar bone, resorption of the marginal bone, thickening of lamina dura, vertical bony defect and periodontal pocket formation . ^(15,16).

It also increases the Osseo clastic activity, decreases the blood flow with subsequent bone resorption. That's why the abutment selection and the stresses generated by the selected post whether ready made or custom made is a crucial factor for the success of the overlying prosthesis.^(17,18).

Therefore , this study was made to evaluate the retention and patient satisfaction outcomes in ready made posts versus custom made posts in mandibular tooth supported overdenture .

MATERIALS AND METHODS

A total of 12 male and female patients were selected from the outpatient clinic of the Department of Prosthodontics, Faculty of Dentistry, Cairo University, using a simple random sampling technique. Their ages ranged from 40 to 60.

These patients were selected based on specific inclusion criteria after appropriate clinical and radiological evaluation. These criteria are: healthy bones and gums with no systemic disease, normal relationship between maxilla and mandible, fully edentulous maxilla contrasted with mandibular arch, premolar teeth of appropriate height are left.

An occlusal vertical inter-arch distance ($\geq 18\text{mm}$) is required to provide sufficient space for both attachments and denture bases. In addition, the abutment condition should be acceptable with clinically correct crown and root lengths ($>12\text{mm}$). Good periodontal condition (must not exceed mobility grade II), root free of calcification and correct crown-to-root ratio present. The patients were divided into two groups, as follows:

1. Group I (Control group) :included 6 patients received a custom made intra radicular post
2. Group II (Test group): included 6 patients received a ready made intra radicular post.

Each patient underwent appropriate oral examination and oral hygiene procedures. Preliminary impressions of both arches were made using alginate impression material (Cavex, The Netherlands). Impressions were then poured to obtain the study models which used to manufacture a special trays.

An intentional root canal treatment of the abutments was then performed. The clinical crowns of the overdenture abutments were then reduced to approximately the level of the adjacent gingival margin, or coronal to it, by 1.5–2.0 mm.

Abutments were treated with topical fluoride application (Ionite APF gel, DHARMA, USA).

A post space was created within each root of the abutment by removing part of the gutta-percha. The root wall was then reamed using a slow-moving peso reamer (MANI peso reamer, Japan).

For group A, (custom made post) a ready-made plastic post with ball head (patrix) was inserted in the prepared root canal and adjusted for the impression. The final pick up impression was made using putty and light body wash addition Silicone (Zetaplus and Oranwash L, Zhermack, Italy), the impression was poured in Type IV extra hard dental stone to obtain the cast. The Wax patterns of coping, the post was then casted by conventional burn out technique into cobalt chromium alloy (Wironit Co-Cr Alloy , Bego, Germany). Fig 1 and Fig 2.

A green stick material (Tracing Sticks, Pyrax Dental Mart.in, Uttarakhand, India) was then used to outline the edges of the upper and lower dental arches to create the border molding with adequate peripheral seal to the depth of the vestibule . A final impression was then made using ZNO/E Impression Paste (Cavex, The Netherlands). Duralay pattern was fabricated and tried in the patient mouth (direct-indirect technique).Fig 3 .



Fig. (1) Teeth preparation ad Insertion of plastic post

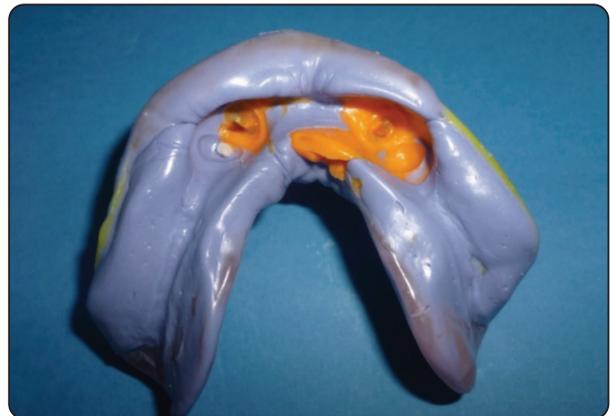


Fig. (2) Final post impression



Fig. (3) Duralay pattern.

Putty index was made to detect the areas of attachments and interferences to be adjusted. The attachment was then placed in place by Mandrel.

Custom posts and copings were tried on both abutments in the patient's mouth and then cemented with a self-curing resin cement (SE T, SDI, Australia). The thickness of the coping should be 1mm or less. Figure 4



Fig. (4) Attachment cemented in place

A final impression was taken with the attachment cemented.

An occlusal blocks were constructed on the master casts with a relief block out around the attachment and the jaw relationship was recorded and transferred to a semi-adjustable articulator using face bow transfer.

Acrylic teeth were selected and set in place, and trial dentures were evaluated in the patient's mouth for proper extension, retention, stability, speech, and esthetics.

After the prosthesis was molded, packed and cured, it was finished and polished.

Attachment incorporation:

An insulating rubber dam was used to prevent excess acrylic from entering the undercut. Each type of retaining cap was then placed over the corresponding post on both groups of abutments. Each prosthesis was mounted on the female component, released properly against the post, and re-inspected for interference.

A small amount of self-curing acrylic resin (Acrostone, Egypt) was placed on the relief area of the denture base opposite the post and the denture was gently placed in the mouth to cure. Patients were asked to lightly bite to ensure proper fit.

Before the acrylic resin was completely cured, the denture base was carefully removed so that the resin did not interfere with the undercut, and the denture base was reinserted until the acrylic resin was fully cured.

The fitting surfaces of the prosthesis were then checked to ensure that matrix attachment was reliably transferred. Excess material was then removed and the fitting surfaces of the prosthesis were finished and polished.

Both groups of prostheses were delivered and instructions were given to the patients after insertion.

However, for Group B (ready made posts), drill holes using the same diameter drill as the posts used to ensure that the posts are fully seated to the prepared root canal. Cemented directly with resin cement. Final impressions were done with the same manner for both groups with regular body rubber base impression material (Thixoflex M, Zhermack, Italy). The impressions were poured in Type IV extra hard dental stone (Zhermack, Italy) to obtain the master cast .

Prosthesis fabrication and attachment incorporation was done in the same manner as Group I.

The Patients for both groups were asked for recall appointments after 1w, 1month, 3 month and 6 month following the overdenture insertion for proper assessment of the denture .

Retention of the overdenture was measured by using a Digital Force meter after 1w, 1m 3m and 6 months . For precise measurement, the dislodging forces should be equal distribution and centralized over mandibular overdenture and the occlusal plan of the mandibular teeth was parallel to the floor as much as we can by instructing the patients to sit in

the upright position on the dental chair and fix their heads during the steps of examination.

The maximum vertical dislodgment force was recorded in Newton's (N); each measurement was repeated five times, and the mean of those measurements was calculated and tabulated to represent the recorded retention value.

Then, the Patients' satisfaction was also measured after 1 week of insertion of the mandibular overdenture that considered after complete adjusting all premature contacts and pressure areas by utilizing a customized chart of question. where; Patients allowed to answer a sequences of questions to evaluate the mandibular overdenture in terms of :masticatory efficiency , speech evaluation ,stability and finally comfort then measurements were repeated after 1m,3 m and 6 m.

Each patient had to give a number describing his General satisfaction (5= Excellent, 4=very good, 3= good, 2= fair, 1= working, 0= not satisfied) Regarding the questions related to evaluate the previous outcomes .

All the results were calculated, tabulated and then statistically analyzed

RESULTS

We calculated the mean and standard deviation values for each group in each test. Data were tested for normality using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The retention data showed a parametric (normal) distribution, whereas the satisfaction data showed a nonparametric (non-normal) distribution.

For parametric data, paired-samples t-tests were used to compare two groups within related samples. A repeated measures ANOVA test was used for comparisons between two or more groups of related samples. However, an independent-samples t-test was used to compare between two groups of unrelated samples. A two-way ANOVA was used to test the interaction between different variables.

For nonparametric data, the Wilcoxon test was used for comparisons between two groups of related samples. Friedman's test was used for comparisons between three or more groups of related samples. However, the Mann-Whitney test was used to compare between two groups of unrelated samples.

The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows

I) Retention:

i) Time effect:

A) Group I (Custom-made post):

It was found that there was a statistically significant difference between (After 1w), (After 1m), (After 3m) and (After 6m) where ($p < 0.001$).

A statistically significant difference was found between (After 1w) and each of (After 1m), (After 3m) and (After 6m) where ($p < 0.001$).

There was also, a statistically significant difference was found between (After 1m) and each of (After 3m) and (After 6m) where ($p < 0.001$).

A statistically significant difference was also found between (After 3m) and (After 6m) where ($p < 0.001$).

B) Group II (Ready-made post):

It was found that there was a statistically significant difference between (After 1w), (After 1m), (After 3m) and (After 6m) where ($p < 0.001$).

A statistically significant difference was found between (After 1w) and each of (After 1m), (After 3m) and (After 6m) where ($p < 0.001$).

Also, a statistically significant difference was found between (After 1m) and each of (After 3m) and (After 6m) where ($p < 0.001$).

A statistically significant difference was found between (After 3m) and (After 6m) where ($p = 0.033$).

ii) Effect of groups:

There was a statistically significant difference between (Group I) and (Group II) where ($p=0.002$) after 1 w, 1m where ($p=0.012$) and after 3m where ($p=0.001$).

However there was no statistically significant difference between (Group I) and (Group II) after 6m where ($p=0.202$).

TABLE (1) The mean, standard deviation (SD) values of Retention of different groups.

| Variables | Retention | | | | p-value |
|----------------|-----------------------|------|-----------------------|------|----------------|
| | Group I (Custom-made) | | Group II (Ready-made) | | |
| | Mean | SD | Mean | SD | |
| After 1w | 20.62 | 1.93 | 17.57 | 1.87 | 0.002* |
| After 1m | 18.38 | 1.50 | 16.24 | 1.91 | 0.012* |
| After 3m | 15.47 | 1.94 | 12.36 | 1.70 | 0.001* |
| After 6m | 11.31 | 1.00 | 10.64 | 1.23 | 0.202ns |
| <i>p-value</i> | <0.001* | | <0.001* | | |

*; significant ($p<0.05$) ns; non-significant ($p>0.05$)

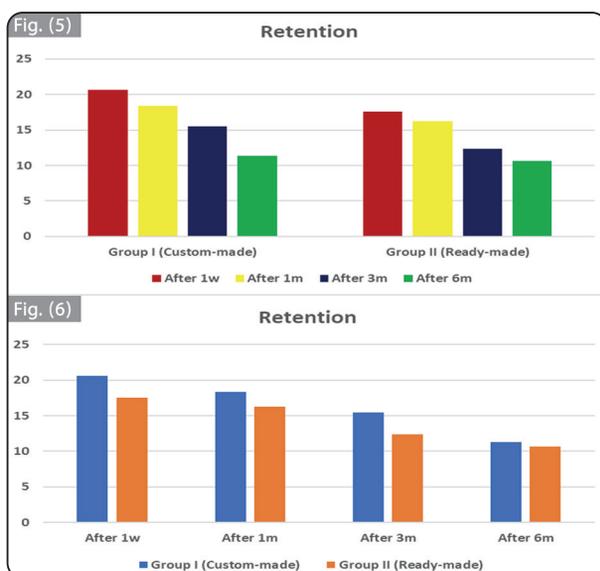


Fig. (5,6) Bar chart representing Retention for different groups and different time periods

Two-way ANOVA:

The results of Two-way ANOVA analysis for the interaction of different variables in table (2) showed that different groups had a statistically significant effect.

Also, time had a statistically significant effect. However the interaction between the two variables had no statistically significant effect.

TABLE (2) Results of Two-way ANOVA for the effect of different variables.

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|-----------------|-------------------------|----|-------------|----------|-------|
| Corrected Model | 900.794 | 7 | 128.685 | 46.155 | 0.000 |
| Intercept | 18785.079 | 1 | 18785.079 | 6737.535 | 0.000 |
| Groups | 100.374 | 1 | 100.374 | 36.001 | 0.000 |
| Time | 780.913 | 3 | 260.304 | 93.362 | 0.000 |
| Groups * Time | 19.506 | 3 | 6.502 | 2.332 | 0.081 |
| Error | 200.745 | 72 | 2.788 | | |
| Total | 19886.617 | 80 | | | |
| Corrected Total | 1101.538 | 79 | | | |

df: degrees of freedom = (n-1), * Significant at $P \leq 0.05$

II) Patient satisfaction:

i) Effect of time:

(A) Group I (Custom-made post):

There was a statistically significant difference between (After 1w), (After 1m), (After 3m) and (After 6m) where ($p<0.001$).

A statistically significant difference was found between (After 1w) and each of (After 1m), (After 3m) and (After 6m) where ($p=0.008$), ($p=0.004$) and ($p=0.005$).

Also, a statistically significant difference was found between (After 1m) and each of (After 3m) and (After 6m) where ($p=0.034$) and ($p=0.004$).

A statistically significant difference was found between (After 3m) and (After 6m) where ($p=0.024$).

B) Group II (Ready-made post):

It was found that there was a statistically significant difference between (After 1w), (After 1m), (After 3m) and (After 6m) where ($p<0.001$).

A statistically significant difference was found between (After 1w) and each of (After 1m), (After 3m) and (After 6m) where ($p=0.007$), ($p=0.004$) and ($p=0.004$).

Also, a statistically significant difference was found between (After 1m) and each of (After 3m) and (After 6m) where ($p=0.021$) and ($p=0.009$).

However, No statistically significant difference was found between (After 3m) and (After 6m) where ($p=0.059$).

ii) Effect of groups:

It was found that there was no statistically significant difference between (Group I) and (Group II) after 1 w where ($p=0.315$), 1m where ($p=0.035$), 3m where ($p=0.011$) and after 6m where ($p=0.123$).

TABLE (3) The mean, standard deviation (SD) values of Satisfaction of different groups.

| Variables | Satisfaction | | | | p-value |
|-----------|-----------------------|------|-----------------------|------|---------|
| | Group I (Custom-made) | | Group II (Ready-made) | | |
| | Mean | SD | Mean | SD | |
| After 1w | 4.30 | 0.67 | 4.00 | 0.47 | 0.315ns |
| After 1m | 3.20 | 0.63 | 2.50 | 0.53 | 0.035* |
| After 3m | 2.60 | 0.52 | 1.70 | 0.67 | 0.011* |
| After 6m | 1.70 | 0.67 | 1.20 | 0.42 | 0.123ns |
| p-value | <0.001* | | <0.001* | | |

*, significant ($p<0.05$) ns; non-significant ($p>0.05$)

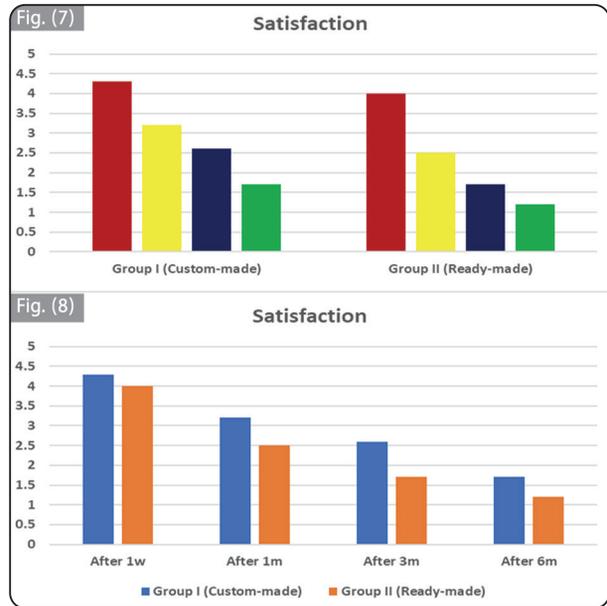


Fig. (7,8) Bar chart representing satisfaction for different groups and different time periods

DISCUSSION

Abutments are the most important component of an overdenture as they maintain the proprioceptive response of the periodontal tissue and also provide a platform for various types of attachments that improve the support and stability of the overall denture. The success of an overdenture post system depends on the relationship between the stress and the strain loaded on the abutment tooth. (19, 20).

The most common attachment system in use today is the prefabricated and customized access post. These post systems are preferred by most dentists due to their ease of use and economics compared to implant-supported overdentures. Due to the tight fit of the overdenture pins, patients require minimal adjustments, reducing the need for repeated visits after denture placement.

However, retention is greatly affected by the stresses produced by these installations and the type of post used to retain a tooth-supported overdentures.

The age range of the selected patients was between 40 and 60 years. This is because patients

over 60 years of age are most likely to have medical disabilities or poor ridge foundations .

Randomization was done via a non-transparent sealed envelopes and patients were divided equally into 2 groups; group I (custom made post), and group II (ready made post)

Although the abutment tooth selected in this study was the 1st premolar, both canines and the 2nd premolars can be used as these teeth have the highest number of proprioceptors. ⁽²¹⁾ .

The custom post was considered as a control group because it allows force transmission to the longitudinal axis of the tooth and minimizes stress concentration on the abutment. ⁽²²⁾

The results of this study show that custom posts have better retention and patient satisfaction outcomes than the prefabricated posts, which is likely consistent with studies showing that custom posts have lower bone resorption than prefabricated posts.

The difference in bone resorption rate between prefabricated posts and custom-made posts can be explained as that the prefabricated post is not accurate and does not exactly fit the root canal, especially because the root canal preparation does not match the length and diameter of the prefabricated post may be the cause. Inside thin, narrow, calcified canals. In many situations, it is necessary to reduce or change the height of the apical post. These factors may explain why the rate of bone resorption is higher.

Araujo and Lindhe conducted studies consistent with the results of this study. They conducted studies on the absorption patterns of the following substances regarding Alveolar bone with complex loads. They showed that the use of prefabricated posts under very complex forces resulted in the loss of the coronal structure of the bone. ⁽²³⁾

For custom made posts, a plastic stud is placed in the center of the cap and aligned prior to casting

the whole. This is beneficial for abutments as the stud is always centered on the tooth regardless of tooth pitch. The force is therefore always directed towards the longitudinal axis of the tooth.

However, the prefabricated post is not always centered on the tooth, especially for the bent teeth. Because they are at the opening of the root canal and form an angle to the long axis of the tooth, forces are not directed towards the long axis of the tooth and more torque is applied to the abutment tooth. ⁽²⁴⁾ .

Several studies on traumatic occlusion suggest a common conclusion that excessive trauma to the alveolar bone through the periodontal ligament causes marginal bone resorption, gingival recession, bone pockets and angular defects. ^(25,26) .

Crumb and Rooney conducted a study that contradicts existing findings. They proposed that a proprioceptor feedback mechanism in the periodontal ligament produces occlusal awareness, which moves the masticatory muscles to position the mandible in the most favorable position, thereby reducing the resorption rate of alveolar bone. ^(27, 28)

Another bone study found that under favorable loading conditions, bone exhibits an adaptive response by stimulating osteocyte activity to form osteoblasts and generate lamellar bone. However, when the bone is heavily loaded, it stimulates alveolar function and promotes bone resorption by stimulating the Osseo clastic activity and woven bone formation. ^(29,30) .

Trulsson and Essick stated that the slow adaptation mechanism of sensation requires numerous fibers in the periodontal ligament. It's function is to regulate the chewing force and motor control. ⁽³¹⁾

Also, custom-made posts are more expensive than the prefabricated posts. It is time consuming and requires additional laboratory steps to manufacture. However, prefabricated posts are cheaper and less time consuming than custom

made posts. Adjustments can be made during the prosthesis-fitting visit. Nonconforming or damaged nylon caps can be repaired by removing them during the chairside lining procedure and replacing them with new caps⁽³²⁾.

CONCLUSION

The results of this study concluded that tooth-supported overdentures are a good treatment option for patients with an edentulous mandibular arch with remaining canines or premolars on both sides. However, custom made posts showed higher retention rates and patient satisfaction outcomes than the prefabricated posts.

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