

Evaluation of quality of life and denture retention of mandibular overdentures using low profile versus self-aligning attachments in completely edentulous patients with limited interarch space. A randomized clinical trial

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ABSTRACT

Aim Clinical evaluation of the effect of using low profile versus self-aligning attachment mandibular over-denture on oral health related quality of life and denture retention.

Material and Methods Forty-two patients were carefully selected, complete dentures fabricated, then two implants were placed in the canine region for each patient. Low profile attachments were used in group I and self-aligning attachments in group 2.

Results Regarding oral health-related quality of life, there was a statistically significant improvement. Regarding overdenture retention, the low profile attachment group showed statistically significant higher retention force compared to that of the self-aligning group at the time of insertion; however, there was no statistically significant difference between two groups at the 6 months follow-up.

Conclusion Both types of attachments offer good oral health-related quality of life for completely edentulous patients with limited inter-arch space. Regarding overdenture retention, low profile attachments presented higher retention values than self-aligning attachments at the beginning of the study but faster retention loss than self-aligning attachment over time.

KEYWORDS Low profile attachments, Self-aligning attachments, Quality of life, Denture retention, Implant overdentures.

INTRODUCTION

Implant overdentures are an effective treatment for edentulous patients as they offer most, though not all, of the benefits of fixed implant prostheses with less cost and complications and with easier maintenance (1,2,3).

There are different conditions that can lead to limited interarch space which may interfere with denture fabrication procedures and limit treatment options (4). Accurate treatment planning is mandatory to avoid any destructive effect to the supporting tissues (5). Accurately mounted casts are critical specially for cases with limited interarch space to assess the available prosthetic space (6).

Attachment profile is a critical feature specially when treating patients with limited interarch space. The **low** profile of the attachment enables the technician to utilize more space for an enhanced esthetic denture set-up. The additional space also provides more room for denture acrylic, which will in turn strengthen the denture (7).

Self-aligning overdenture attachment is a widely used low profile attachment that has many advantages as self-aligning and dual retention properties, and can accommodate up to 40 degrees inter implant angulation. One of the main advantages of the self-aligning attachment is its low vertical profile which helps in many difficult clinical situations (8,9,10,11).

The low profile attachment introduced in 2013 is made of titanium alloy with a titanium nitride coating and the metal housing is also made of titanium alloy (8). The low profile attachment is considered the smallest attachment system available with the least overall dimension (vertical height of 2.1 mm and 4.4 mm diameter) which make it successful and effective (12).

A study that compared different implant overdenture attachments showed that the new low profile attachment offers a lower profile than self-aligning attachment

with adequate retention and is compatible with different implant brands. The low profile attachment gives all the advantages of the additional space with optimum retention and quality. Other authors added that low profile attachments offer a lower profile than the locator attachment but there is no enough researches that compare low profile with other types of attachments (7,9).

MATERIALS AND METHODS:

Forty-two completely edentulous patients (33 M - 9 F) were selected. A total of 84 implants were inserted for the placement of 42 implant-supported mandibular overdentures (21 for each group) (Fig. 1). All patients attended the 6-months follow-up. All participants were carefully examined and a panoramic radiograph was taken for each participant, with full medical and dental history to ensure that the patient was medically fit for the research. All participants in the study were informed about the nature of the research work and informed consents was obtained for every one of them.

Intervention procedures

A conventional complete denture was constructed for all patients before dividing them into 2 groups. Secondary impressions were made by means of zinc oxides and eugenol impression material (Cavex, Netherlands), a face bow (Bio-art facebow, Brazil) record was made (Fig. 2A) to mount the upper cast on a semi-adjustable articulator (Bio-art semi-adjustable articulator, SM66297, Brazil). The lower cast was mounted in centric occluding relation. Acrylic resin teeth (Cosmo MEA, Densply-USA)

of appropriate shape, size and shade were arranged and then tried in the patient's mouth to achieve a proper esthetic and phonetic form (Fig. 2B).

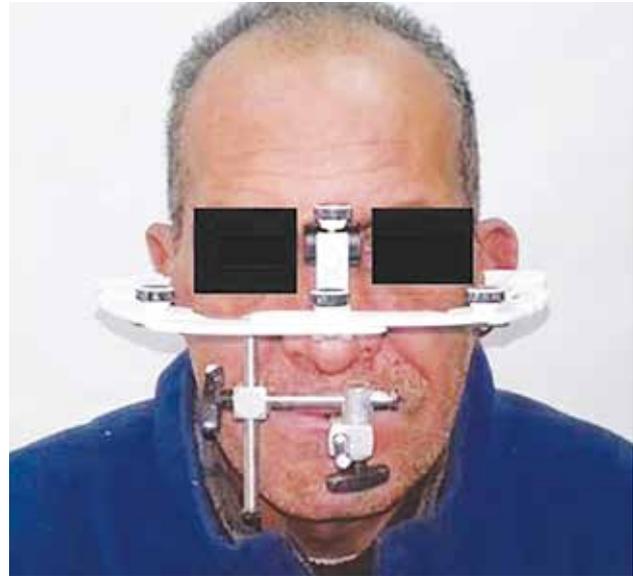


FIG. 2A The face bow.



FIG. 2B The try in on the articulator.

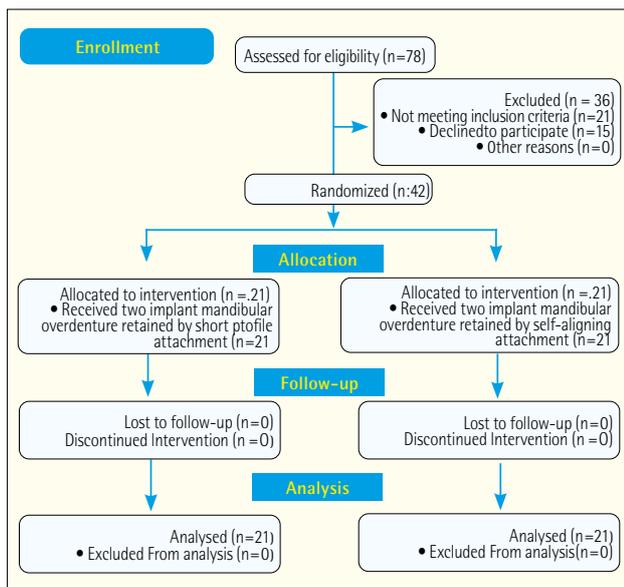


FIG. 1 Patients' selection and group allocation.



FIG. 2C Radiographic stent intraorally.

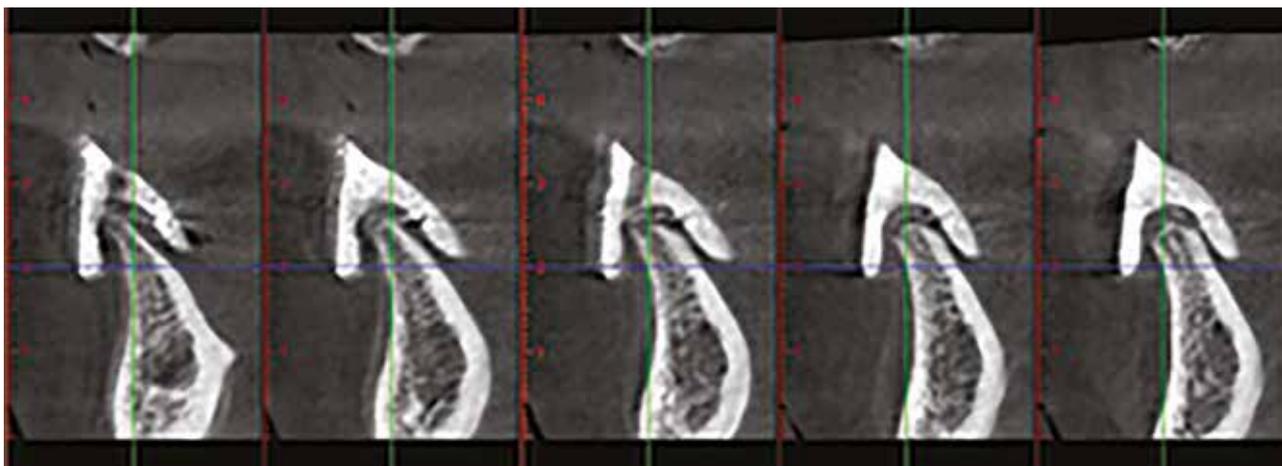


FIG. 2D The radiographic guide on CBCT scan.



FIG. 2E Converting radiographic stent to surgical stent.

The dentures were then flaked and processed with heat cured acrylic resin (Acrostone, Dental Factory – Industrial Zone, Salam City, A.R.E).

Patient grouping

The selected patients were allocated as follows:

- Sequence generation was performed by Random sequence generator on the web site "www.random.org" to obtain the numbers related to each group (done by the assistant).
- Allocation concealment was done by using opaque sealed envelopes (done by the researcher).
- Implementation: The researcher told the assistant the number and name of each participant to build up names within each group. During the research steps, the participants and statistician were blinded but the researchers couldn't be blinded.

Stent fabrication

The lower dentures of the patients were duplicated using radio-opaque resin to fabricate a radiographic stent. Cavities were drilled in the stent corresponding to each tooth for implant placement (Fig. 2C).

All patients were underwent CBCT while wearing the

radiographic stent to ensure the presence of suitable bone dimensions at the canine region. Later (Fig. 2D), the radiographic stent was converted into surgical stent (Fig. 2E) by reducing the lingual flange to increase accessibility (11), so that the locator drill could be used easily through the surgical stent to accurately determine the future implant position.

Implant were placed using delayed loading protocol according to the manufacturer's instructions (IHDE DENTAL dental implant system, Switzerland). After the healing phase of the osseointegration (3 months), the implants were uncovered.

After complete healing, for Group 1 low profile attachments were connected to the implants (Fig. 3A) and for Group 2 self-aligning attachments were connected to the implants (Fig. 3B).

Chambers were created on the fitting surface of the lower denture corresponding to the metal housing of the attachments. Then a through hole was done to allow removal of excess material to avoid pressure that may cause settling of the denture or interfere with its fitting surface.

The fitting surface of the lower denture was cleaned, dried and painted with hard liner adhesive. The hard liner paste was applied to the fitting surface of the lower denture. The hard liner paste was also applied to the patient mouth around the attachment metal housing. The lower denture with the paste was introduced in the patient mouth and seated over the attachments. The upper denture was inserted intra-orally and the patient was instructed to close in centric occlusion. Gentle molding of denture borders was done while the patient was closing. After complete hardening of the paste, the denture was carefully removed from the patient mouth and excess material was trimmed and polished.

The processing nylon cap was removed from the metal housing and the final cap was placed for self-aligning attachments (Fig. 3C) and for low profile attachments (Fig. 3D). At that step, the denture was ready to use.

The Arabic version of the Oral Health Impact Profile for



FIG. 3A short profile attachment.



FIG. 3B Self-aligning attachment.



FIG. 3C The denture with final nylon cap for self aligning attachment



FIG. 3D The denture with final nylon cap for Equator attachment.

edentulous patients (OHIP-EDENT) was used specifically to evaluate the impact of implant prosthesis on the patient's quality of life. The format of a typical question was as follows: "How often have you had (impact item) because of problems with your dentures?" Responses to the items were recorded by using a five-point scale:

- 0, never;
- 1, rarely;
- 2, sometimes;
- 3, most of times;
- 4, always.

The total score was then calculated, higher scores indicate poor OHRQoL.

Comparison between the two groups of the study regarding the retention of the mandibular overdenture was made according to the method reported by Jose F. Mañes et al. in 2011 (13) using a spring scale to measure retention strength (in newton). With the mouth open and the lower lip relaxed in order to avoid losing peripheral sealing, the tip of a spring scale was placed at the margin of the dentures, in the recess of the lower labial frenulum (Fig. 4). Traction was then applied until the dentures detached, the maximum retention force being registered by the spring scale.

RESULTS

The study sample included forty-two completely edentulous patients (33 males and 9 females) with average age of 41-57 years; 84 implants were placed

(42 in each group). All participants underwent sixth month's follow-up (Fig. 1). No implant loss was detected in any group, resulting in a success rate of 100% at the end of the follow-up period

Data were analyzed using the Statistical Package of Social Science (SPSS) program for Windows (Standard

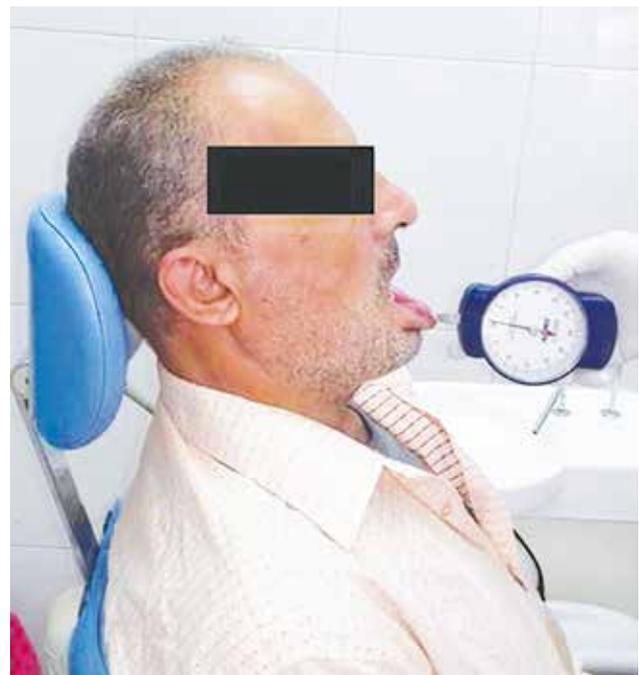


FIG. 4 A spring scale used to measure overdenture retention

version 24). The normality of data was first tested with Shapiro test. Continuous variables were presented as mean \pm SD (standard deviation) for parametric data. The two groups were compared with Student t test while paired groups were compared by paired t-test.

Oral health related quality of life

Effect of time on the quality of life: There was a statistically significant improvement from time of insertion to 6 months follow-up periods for all patients in all groups.

At time of overdenture insertion, the low profile attachment group showed higher values than the self-aligning attachment group but the difference was not statistically significant.

Six months later, low profile attachment group showed again higher values than self-aligning attachment group with no statistical significance (Fig. 5A).

Overdenture retention

Effect of time on the overdenture retention: Within both groups, there was a decrease of retention from the time of insertion to the 6 months follow-up periods with statistically significant difference.

At the time of overdenture insertion, low profile attachment group showed statistically significant more retention force compared to that of self-aligning attachment group.

Six months later, there was no statistically significant difference between two groups of study (Fig. 5B).

DISCUSSION

Oral health impact profile for the edentulous patients (OHIP-EDENT) was used specifically to evaluate the impact of implant prosthesis on the edentulous patient's quality of life. The Arabic version used to allow the patient to completely understand the questions and accurately assessed.

Regarding the Oral Health-Related Quality of Life, there was a statistically significant enhancement in OHRQoL over time in all patients in both groups. This may be due to enhancement of patient habit to use the overdenture and increased denture settlement with time. Enhancement of OHRQoL with time was also reported by Lang et al. in 2016 (14), Cardoso et al. in 2016 (15) and Yunus et al. in 2014 (16).

The approximate results may be owed to enhanced overdenture retention within the two groups. So that, the use of any of the two types of attachment will enhance the OHRQoL. These results were comparable to those of Bilhan et al. (2011) (17) and Kleis et al. (2010) (18), as they found no significant difference between different attachments types regarding OHRQoL.

Regarding the overdenture retention in both groups, there was reduction in the retention value from time

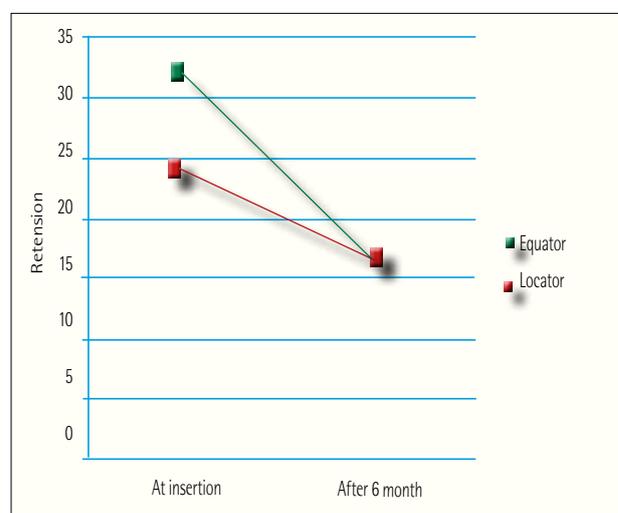
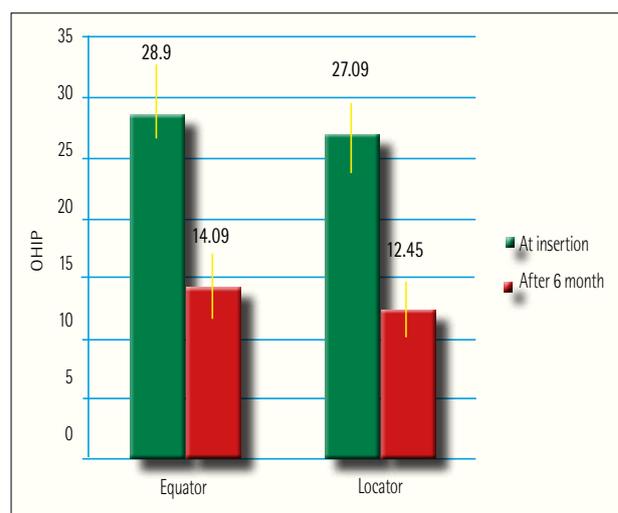


FIG. 5

A: Comparison between Equator and Locator groups regarding OHIP at insertion and after 6 months.

B: Comparison between Equator and Locator groups regarding Retention at insertion and after 6 months.

of insertion to six month's follow-up periods with statistically significant difference. This decrease may be due to rapid wear of the nylon cap which may be related to high attachments retention. These results were comparable to those of Uludag et al. in 2014 (19), as they found that different attachment systems demonstrated a decrease in retention over time. Although low profile attachments (Equator) have lower profile than self-aligning attachments, at the time of overdenture insertion, the former (group 1) showed statistically significant more retention force compared to the latter (group 2). This increase in retention may be owed to the attachment's design which allows the nylon cap to excessively engage the attachment body. Equator attachments offered greater retention at the beginning of the study but unfortunately they

showed more rapid retention loss. So that, at the six months follow-up, there was no statistically significant difference between the two study groups.

This results disagrees with Satti, 2013 (8), who compared in an *in vitro* research low profile and self-aligning attachments. Satti reported that, at the start of the simulation, the self-aligning attachment showed higher retention though with no significant difference, whereas after one year retention loss occurred in both groups, but self-aligning attachments still showed significantly higher values, which reflects the more rapid retention loss in low profile attachments.

The loss of retentive forces is expected over time due to wear of attachment parts; this may be related to deformation caused by prosthesis removal and insertion, as reported by Alsabeeha et al. in 2009 (7). This was also analyzed by Kleis et al. 2010 (8), who clarified that there is an association between the plastic part wear and retention loss when they compared the locator group with two conventional designs, where the locator group displayed 75.5% retention loss. The retention forces increased at the time of pickup of the denture and stabilized in the following 3 months then decreased after one year of follow up due to wearing of plastic of locator. This is in harmony with the results of Williams et al. (2007) (20) who observed, in an *in vitro* study on a model with a Harder bar and three clips, that the retention force reduced due to regular denture setting and removing and stabilized afterwards.

This opinion confirms the clinical experience that retention loss is compensated through activation or replacement of the matrix, as reported by Jemt et al., 1992 (21), Davis and Packer 2000 (22), Zitzmann and Marinello 2000 (23).

CONCLUSION

Within the limitations of this study, it was concluded that; Oral Health-Related Quality of Life was not affected by the attachment type or the attachment profile. Regarding overdenture retention, Low profile attachment presented significant higher retention values than self-aligning attachment at the beginning of the study but it showed faster retention loss than self-aligning attachment with time with no significant difference between the experimental groups at the end of the study.

Recommendations

Low profile attachment is highly recommended in cases with limited interarch space as it has a low profile with adequate retention without jeopardizing the OHRQoL. Further studies needed to evaluate low profile attachment and to compare it with other types of attachments.

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