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The Effect of Flexible Acrylic Resin Lingual Flanges on The Retention of Mandibular Complete Dentures

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ABSTRACT

To evaluate the effect of flexible lingual flanges on the retention of conventional mandibular complete denture. **Material and methods:** Ten completely edentulous patients were selected for this study with ages ranged from 50-60 years. All patients had received heat cured acrylic resin denture without modification (Group I) then heat cure lingual flanges were removed and replaced by flexible_lingual flanges (Group II). All patients were instructed to use their resin dentures for equal periods of three months when retention of denture base were measured after one month and at the end of three months, period of two week interval was left between each group as a washing period. **Results:** The results of this study showed that there was a significant difference between them, as the flexible_lingual flanges (group II) was better than the heat cured acrylic resin denture base (group I). **Conclusion:** Within the limitation of this study, it was concluded that retention of the mandibular denture modified with flexible acrylic resin "versacryl" was higher than that of the conventional heat cured acrylic resin denture. Retention was increased by time in each study group. The use of flexible acrylic resin in mandibular complete dentures (as lingual flange) could be considered as an alternative effective treatment.

KEYWORDS

Lingual Flanges,
Flexible Acrylic Resin,
denture Retention

INTRODUCTION

Polymethylmethacrylate (PMMA) resin has been successfully used for various applications in dentistry for many years. It has many advantages, particularly its appearance and ease of manipulation, but it still has certain poor mechanical properties. Fractures may occur during use due to unsatisfactory impact and transverse strength. Dimensional stability is of considerable importance as a clinical problem as well. Therefore, in the clinical practice of dentistry, there are many circumstances in which the need to adjust denture base acrylic resin is necessary [1].

- Paper extracted from master thesis titled "The Effect of Flexible Acrylic Resin Lingual Flanges on The Retention of Mandibular Complete Dentures"

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The retention of complete denture is considered one of the most difficult problems facing prosthodontists. One possible and simple way of enhancing denture retention is by extension of denture flanges to engage an existing soft-tissue undercut. However, extension of conventional denture bases into soft-tissue undercuts should be kept minimal due to rigidity of acrylic resin [(2)].

Flexible acrylic resin increased the chance for denture bases to be extended into deeper soft-tissue undercuts to gain further retention [(3)].

Flexible dentures use a special flexible resin that act as a soft base prevents the denture from rubbing the gingiva, allows the wearer to chew properly [(4)].

An alternative denture prosthesis design, in which optimal flange height and thickness, can be achieved by using flexible denture base material. It's considered as an excellent alternative to traditional hard-fitted dentures and traditional denture liners which increases the patient comfort at the cost of chewing efficiency. A flexible material is now an option that does not trade off the ability to eat[(2)].

The aim of this study was to evaluate the effect of flexible lingual flanges on the retention of conventional mandibular complete denture.

MATERIAL AND METHODS

Ten completely edentulous patients were selected. Patients' ages ranged from 50-60 years. All patients were free from any temporo-mandibular joint disorder or parafunctional habits and they had no previous experience in wearing dentures to eliminate the expected adaptation of the muscle and all patients accepted this dental treatment and informed about the steps of this study and signed a written consent with the Research Ethics Committee (REC) approval.

The ten patients were received heat cured acrylic resin maxillary and mandibular complete denture then heat cure lingual flanges were removed and replaced by flexible_lingual flanges. The denture base material used in this study were divided into two groups of denture base materials; Group I (conventional heat cured acrylic resin) and group II (flexible lingual flanges) .

Patient history and clinical examination for medical, dental, extra oral, intra oral and radiographic examination were carried out for each patient.

Construction of flexible lingual flanges

All undercuts of the teeth and the polished surface of the mandibular denture base were blocked except the lingual flanges. Then, separating medium was applied on the denture and the cast then flasking was done. The cast was secured into the base of the flask with stone taking into consideration that no undercuts existed on the surface of this first step.

After the stone was allowed to set, the flask was opened and the mandibular denture was removed from the cast. A line of demarcation was delineated on the lingual flanges of the acrylic resin denture base with an indelible pencil. The lingual flanges of mandibular denture were cut at the line of demarcation with dough tails to increase the surface area for connection between the flexible and the conventional acrylic resin using ultra thin disk.

The manufacture recommendation was followed to obtain the required rigidity for versacryl (Keystone Industries GmbH, Sigen, Germany) lingual flanges. In a small mixing cup (30% softener monomer liquid +70% hardener monomer liquid) was added and stirred together for about 10 seconds, then 1 part of liquid was added to 1.5 part of powder by weight then stirred until it was thick enough to knead.

Versacryl was packed against acrylic denture area from which the resin had been removed, flask was closed, pressed and procedures were completed as conventional heat cure resin as it did not require any special equipments. Deflasking and finishing was accomplished (Fig. 1).

Fig. (1) The mandibular denture with the flexible lingual flanges

Before insertion of dentures with flexible lingual flanges, the mandibular denture was immersed in hot water bath (95°C) for 5 min to soften the flexible flange, so that they can be easily adjusted to adapt the undercut area of the mylohyoid ridge.

Assessment of denture retention

The retention of mandibular dentures for both groups was tested 1 month and 3 months following denture insertion. A digital force-meter (Ebalance , China) was used to measure denture resistance to vertical displacement (i.e., retention) by applying a pulling force on a metal hook located in the geometric center of each mandibular denture.

Identification of the geometric center for each mandibular denture

Based on geometrical principles[5], identification of the geometric center for each mandibular denture was carried out. All undercuts in the fitting surface of the denture were blocked by base plate wax. A mix of plaster was then poured into the fitting surface of the denture and another mix was used to construct a base. The centers of the retromolar pads and the midline were marked on the polished surface of the denture (fig. 2a).

A cardboard was cut out so as to form a triangle which was placed on the plaster base to occupy the space in between the three aforementioned markings. After that, three lines bisecting the three angles of the triangle were then drawn on the cardboard. The intersection of these three lines was considered the geometric center of the denture. (fig. 2b)

Following the former step, a pin was passed through the cardboard at the identified geometric center to mark a point on the plaster base. A metallic rod was then fixed to the base and suspended upward from the marked point to maintain the location of the geometric center. Three “V” shaped grooves were created on the polished surface of the mandibular denture; one was made on the lingual flange at the midline region just below the central incisors and the other two grooves were created at the retromolar pad area just distal to the second molar of both sides. A wrought wire of 1 mm in diameter was then bent at its center and adjusted so as not to encroach on the tongue space and to run 2 cm above the occlusal plane from the retromolar pad groove of one side to the retromolar pad groove of the other side.

Afterward, a second wrought wire of the same diameter was adjusted to extend from the groove at the lingual flange upward, so that it is 2 cm above the occlusal plane. The two wrought wires were then bent toward each other until they met at the identified geometric center. One end of the second wire was adapted in the created groove just below the central incisors and the other end was shaped to form a c-shaped loop around the first wire. The free ends of the two wires were then fixed to the polished surface of the mandibular denture by self-cured acrylic resin. (fig. 2 c and d)

Statistical analysis

Data collected was reviewed. Statistical analysis of collected data was done by using SPSS program (Statistical package of social science; SPSS Inc., Chicago, IL, USA) version 16 for Microsoft Windows. Descriptive statistics in the form of mean and standard deviation were calculated to measure central tendency and dispersion of quantitative data. Since data was normally distributed, as it passed normality test, student t test was performed to compare means of different groups, while paired t test was done to compare means of the same group. Level of significance was taken at p-value of <0.05. The results were represented in tables and graphs.

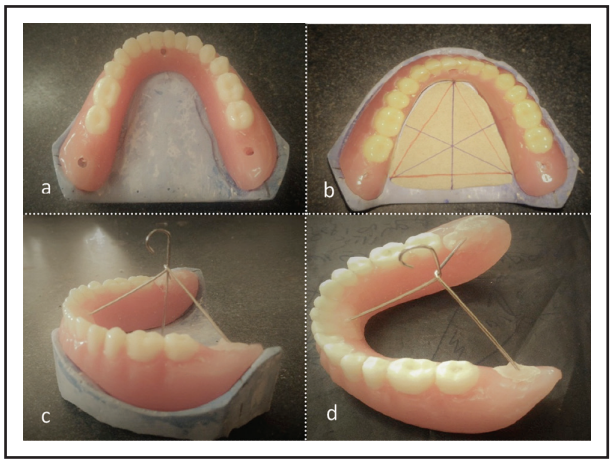

Fig. (1) a-The markings on the mandibular denture. b-Identification of the geometric center of the mandibular denture on the cardboard. (c and d) The second wire adjusted to meet the first wire at the geometric center with its free end bent into a c-shaped loop.

RESULTS

I-Effect of time and denture base material on the denture retention:

Over the study period, all patients attended the follow-up and no major adjustments were required for the constructed dentures.

The t-test was used to test the results of this study. The statistical test indicated that retention of dentures with flexible lingual flanges was significantly higher than retention of conventional dentures at the different follow-up appointments ($P < 0.05$).

With both types of denture base materials there was a statistically significant ($p<0.05$) increase in mean retention value after 1month and three months (table 1).

II- Percentage changes in retention force results for both denture material groups

The difference between retention forces for conventional and versacryl denture base materials at different follow up periods was statistically significant as revealed by paired t-test ($p <0.05$)

Statistical analysis of the mean percentage change in retention force from the preceding values for conventional and versacryl denture materials between 1month and 3 months revealed statistically significant differences by student t test ($p<0.05$), so the increase in retention of versacryl was in a higher rate than the conventional acrylic resin after three months of denture insertion (table 2).

Table (1): *Comparison of mean and standard deviation of retention force measured in grams for study groups with both denture materials at different follow-up periods.*

Duration / Groups	After 1 month	After 3 months	Paired t test	P value
Group I				
(Conventional)	172.88±124.61	420±219.28	4.26	0.004*
Group II				
(Versacryl)	739±159.81	1127.50± 284.49	4.49	0.003*
Student t test	7.90	5.57		0.000*

**significant difference (p value < 0.05)*

Table (2) *Comparison between mean percent changes in retention force results for both denture material groups*

Retention force / Groups	Percent change% (mean± SD)	Student t test	P value
Group I (Conventional)	63.1±32.5	2.30	0.039*
Group II (Versacryl)	203.21± 158.05		

**significant difference(p value<0.05).*

DISCUSSION

As the sex was not considered as a factor in our study, ten patients were selected seven males and three females for this study as the study was on comparing the retention of flexible acrylic resin lingual flanges with the conventional resin lingual flanges [6].

The age ranged between 50-60 years. Very old patients were excluded because there are many factors that would complicate denture treatment process of aged patients such as decreased neuromuscular coordination [7].

In the present study, the posterior part of the edentulous mandibular ridge were selected rather than the anterior nor the maxillary ridges since the amount of bone resorption is generally greater in the mandible than the maxilla, and after mandibular anterior teeth extraction, the distal part of the mandible is more in use and the resorption process is more extensive, which implies that the mandibular denture usually possess greater clinical problem for the patient and the prosthodontist[8].

In this study, there were two groups of denture base material. Group I Conventional heat cure acrylic denture base (PMMA), it is the most widely used denture base material in fabrication of nearly all denture bases. Heat curing is the most popular method of processing denture base acrylics. The heat curing system is selected because the accuracy is adequate, good resistance to attack by solvents and the laboratory cost is substantially less[9].

Group II Mandibular denture with flexible lingual flanges. A previous study[10] mentioned that flexible resin (versacryl) is a multipurpose acrylic that provides more than 50 unique applications to improve removable dental appliances, by enhancing retention, esthetic and patient comfort, also it can be extended into lingual undercut to mechanically retain the denture.

In the present study, a new methodology was followed after the patients used their conventional dentures to replace the conventional heat activated polymethylmethacrylate resin lingual flanges with heat activated flexible resins, versacryl, to standardize all variables that may affect the results.

Firstly, flasking was done to maintain the width and depth of the lingual flanges. The lingual flanges of the denture base was cut into dough tails to mechanically interlock with versacryl and to increase the area required for chemical bonding between the versacryl and the conventional resin, then mixing of the versacryl, packing, curing, finishing and polishing were done as usually done with a conventional heat cured acrylic resin, as it did not require any special steps nor equipments.

In vivo retention measurements are preferable because intra-oral factors such as the presence of saliva is considered [11]. Retention force evaluation of testing group was done by using a digital force-meter. The patient posture used for performing measurements was the seated position [12]. The metallic probe of the force meter was attached to the c-shaped metal hook created at the geometrical center of the denture bases [13].

Flexible dentures are exceptionally strong, flexible, free movement is allowed by the overall flexibility, and completely biocompatible [14].

In this study, it was obvious that the retention of the flexible acrylic resin "versacryl" lingual flanges in mandibular complete denture was higher than that of the conventional heat cured acrylic resin.

Over the follow-up period, there was an improvement in denture retention for both types of dentures after 3 months more than 1 month. This finding can be explained by the improved fit of the denture bases due to the medium-term remodeling of the soft tissues underlying the dentures in order to maintain the mucosal contact with denture bases.

The results obtained were in agreement with another study [15] that claimed that the higher retention force of flexible acrylic resin may be attributed to maximum adhesion of the flexible acrylic resin lingual flanges to the underlying mucosa and the extension into lingual pouch undercut to mechanically retain the denture, as flexible resin is able to use areas of the ridge that would not be possible with conventional denture, since hard and soft tissue undercuts are frequently encountered in the fabrication of prosthesis in completely edentulous arches[2].

Also higher retention of flexible resin may be attributed to the property of atmospheric pressure which acts to resist the dislodging forces applied to the dentures if the dentures have an effective seal around their borders, and as there is intimate contact between flexible acrylic resin denture and the supporting structures, this was accepted by another study that reported that the retention due to atmospheric pressure is directly proportional to the area covered by the denture base and to the intimate peripheral seal[16]. Thus, effective mechanical and physical factors interplayed to produce better retention for mandibular complete dentures with flexible acrylic resin flanges.

The increase in retention of flexible acrylic resin denture base than the conventional heat cure one was in agreement with other studies [17] that reported that, the use of flexible acrylic flanges to construct stable, retentive, well-adapted, and comfortable complete dentures record bases since the flexible flanges sections are sufficiently elastic to engage and then release from undercuts, also the flexibility of the inner section of the flanges permits atraumatic insertion and removal from a patient's mouth, despite overall base rigidity.

CONCLUSION

Within the limitations of this study, it can be concluded that:

- Retention of the mandibular denture modified with flexible acrylic resin "versacryl" was higher than that of the conventional heat cured acrylic resin denture.
- Retention was increased by time in each study group.
- The use of flexible acrylic resin in mandibular complete dentures (as lingual flange) could be considered as an alternative effective treatment.

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