

# The Effect of Soft Lining Materials on Mandibular Residual Ridge Resorption for Edentulous Patient

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## الخلاصة

**الأهداف:** تهدف الدراسة الى تحديد تأثير بطانة الطقم الطرية على معدل ارتشاف الفك السفلي باستخدام تقنية خاصة في جهاز الأشعة الرقمي والاستفادة من سهولة ودقة العمل والتعديلات التي يمكن الحصول عليها بواسطة هذا البرنامج، فضلا عن تقييم مدى اقتناع المرضى باستخدام الطقم ذو البطانة الطرية و مقارنته مع طقم الاكريل الاعتيادي. **المواد و طرائق العمل:** أجريت الدراسة على (35) مريضا فاقدى الأسنان كليا قسموا إلى ثلاث مجاميع، المجموعة الأولى 5 مرضى لم تستخدم أي نوع من الأطقم، أما المجموعة الثانية 15 مريضا فقد استخدمت طقم الاكريل الاعتيادي بينما استخدمت المجموعة الثالثة 15 مريضا الطقم المزود ببطانة طرية. أخذت ثلاث صور شعاعية لكل مريض بفاصل زمني قدره ثلاثة أشهر بين صورة شعاعية و أخرى، كما اجري استبيان لتقييم مدى اقتناع المرضى بالطقم. **النتائج:** تشير النتائج أن الاختلاف غير معنوي لامتنصاص العظم بين المجاميع الثلاثة. **الاستنتاجات:** وقد وجد إن المرضى الذين استخدموا الطقم ذو البطانة الطرية كان لديهم تقبل أفضل للطقم و قدرة أكبر على المضغ من الذين استخدموا الطقم الاعتيادي.

## ABSTRACT

**Aims:** The aims were to evaluate mandibular residual ridge resorption for patients wearing lower complete dentures made of heat curing acrylic resin lined with acrylic soft liner and compare it with patients wearing conventional heat curing dentures and compare patients satisfaction with dentures for both groups. **Materials and Methods:** Residual ridge resorption was evaluated in 35 male patients through a period of 6 months by means of digital panoramic radiographs, the patients divided into three groups, first group 5 patients not used prostheses, the second group 15 patients worn conventional heat curing dentures and the third group 15 patients worn dentures lined with acrylic based soft liner, the patients also surveyed about their satisfaction with dentures. **Results:** The results indicated insignificant difference in the rate of residual ridge resorption between the three tested groups in 6 months period. **Conclusions:** There is no significant difference between conventional heat curing dentures and dentures lined with acrylic based soft lining material regarding the rate of residual ridge resorption. Regarding denture satisfaction, most patients seem to have more comfortable denture and better chewing ability by using soft liners.

**Keywords:** Mandibular residual ridge resorption, Soft liners, Patient satisfaction.

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## INTRODUCTION

Bone is a dynamic tissue capable of adaptation to meet tension or compression forces falling upon it. The structure and function of bone are dependent on the complex interactions between its constituents, although the precise composition of bone differs with species, site, age, and disease state.<sup>(1)</sup> It is an active tissue that is continuously formed and resorbed throughout the human life cycle until a person is approximately 30 years of age, bone resorption exceeds bone formation

and results in a reduction in bone mass throughout the skeleton.<sup>(2)</sup>

Bone resorption of the residual ridge is a common occurrence after the extraction of teeth, it appears to be a process encountered in all patients, albeit, there is a considerable inter individual variation in the rate of bone loss after tooth extraction and the wearing of complete dentures, these variations could be attributed to many factors, anatomic, metabolic, functional, or prosthetic factors.<sup>(3,4)</sup> The type of denture base material has been cited as one of

the factors that influence the rate of residual ridge resorption<sup>(5)</sup> and in the past three decades the relationship between residual ridge resorption and different types of materials used in prosthodontics has received increasing attention in the prosthodontic field.<sup>(6)</sup>

When forces are applied through a hard base, the supporting tissue can be damaged which results in chronic soreness, abused tissues, and bone loss, theoretically soft liners should distribute and absorb forces by means of cushioning effect<sup>(7)</sup> leading to improvement of fitting denture surface and reduce transmission of forces to the residual bone.<sup>(8,9)</sup> Various qualitative and quantitative indices and techniques had been used for describing the resorptive changes in the mandible, computer-assisted image analysis has been shown to improve the diagnostic accuracy. Consequently, the use of digital image analysis has been expanded to monitor amount of bone resorption and also gain or loss of alveolar bone density,<sup>(10)</sup> comparisons of measurements made on panoramic radiographs have been made to actual measurements on patients or to various markers.<sup>(11)</sup>

## MATERIALS AND METHODS

Thirty-five completely edentulous male patients were selected from the clinic of prosthodontic department, College of Dentistry at Mosul University, their age ranged between (48 – 70) years old. All patients fulfilled the following criteria:

1. They were edentulous for at least one year

2. No history of systemic disease that could affect general bone status.

3. All patients have no previous dentures.

The selected patients were divided into three groups as follows:

Group A: 5 patients did not receive any prosthesis

Group B: 15 patients received a set of complete dentures made of heat curing acrylic resin

Group C: 15 patients received mandibular complete dentures made of heat curing acrylic resin lined with permanent acrylic soft liner and maxillary complete dentures made of heat curing acrylic resin.

Rubber base impression material of addition type (Zeta-Plus, Zhermack, Italy) was used for taking the final impression with a mucostatic impression technique, then impression is poured, and occlusion rims were constructed, after that jaw relations were established then the casts were mounted using simple articulator, acrylic artificial teeth of anatomic form (RMH, Syria) were used for the dentures.

The acrylic based soft lining material (vertex company, Netherlands) was used in the mandibular dentures in such a way that is also formed the borders of the dentures in 2 mm thickness and was supported by hard acrylic resin (vertex company, Netherlands):

1. After flasking and wax elimination had been done in the usual manner, a vacuum formed spacer is placed in the position in the lower cast with a thin sheet of packing plastic between the spacer and the mixed acrylic resin, this will give a uniform thickness of 2 mm.

2. The flask is tightened in a bench press and left for 45 minutes, this will allow the acrylic resin to stiffen a little bit.

3. The flask is opened and the spacer and packing plastic sheet are removed.

4. The unpolymerized soft lining material is added to the half of the flask containing the acrylic resin, press again, the flask is put in a hot water bath for 90 minutes then the water is allowed to boil for 30 minutes, then the flask is left to cool, opened and the polishing is done in the usual way but caution should be taken when trimming that should be carried out with utmost care to prevent tearing the soft lining material.<sup>(12)</sup>

All dentures were inserted, the occlusion of the patients' were adjusted and there was no premature contact between the opposing teeth, and the patients were instructed to recall for checking any problems with the dentures, and they were instructed to wear dentures at day only for 12 hours.

All patients were submitted to panoramic digital radiograph on three months intervals for the purpose of measuring the height of mandibular residual ridges, the first radiographs were at the day of denture

insertion, the second radiographs were taken after three months, and the third radiographs were taken after six months from the first radiographs. A one centimeter length wrought wire was stuck on the denture base in both the right and left sides near the mental foramen area in order to control the amount of magnification, the mandibles were examined on panoramic

images taken with digital x-ray machine (Planmeca, Helsinki, Finland), at upright position of the patient and fixation of exposure value on 80 Kv, 12 mA, and exposure time of 18 seconds. On the basis of radiological analysis of the panoramic radiographs as described by Wical and Swoope, (1974) a resorption index **A/B** was calculated ( Figure 1)

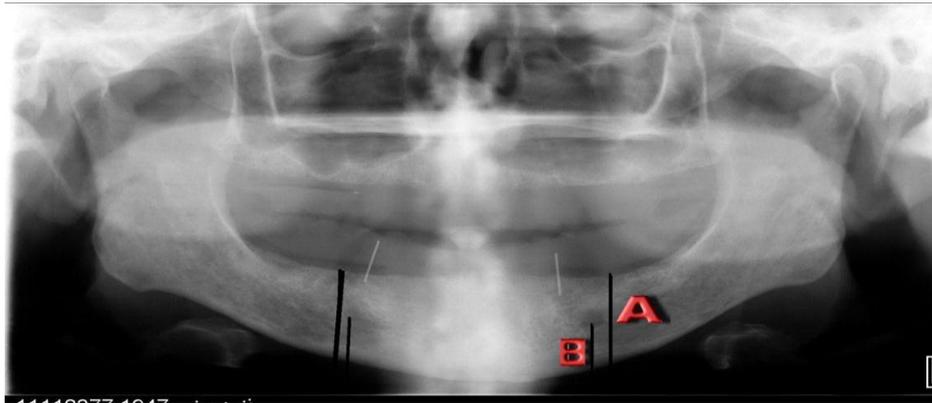


Figure (1): Method of evaluation bone resorption

Where **A** is the distance between the inferior ridge of the body of the mandible and the ridge of the alveolar part adjacent to the mental foramen, and **B** is the distance between the inferior ridge of the mandible body and the inferior margin of the mental foramen. The measurements were taken from the patients' radiographs, both the right and left sides of the mandibles then the mean of them was taken.

To evaluate patients' satisfaction with mandibular complete denture a prepared questionnaire was used to provide an idea about patients' satisfaction of dentures with soft liners and compare it with those with hard acrylic resin, the same patients were surveyed about their satisfaction with dentures; 15 patients used mandibular complete dentures made of heat curing acrylic resin, and 15 patients used mandibular complete dentures made of heat curing acrylic resin lined soft lining material, questionnaire was as follows:<sup>(15)</sup>

1. Does your lower complete denture come loose while speaking, swallowing, or yawning ?

2. Have you found it uncomfortable to eat any food because of problems with your lower complete denture ?
3. Does your lower complete denture come loose while you are eating /chewing hard food ?
4. Does your lower complete denture come loose while you are eating/chewing soft food ?
5. Have you felt that your lower complete denture have not being fit properly ?
6. Does your lower complete denture hurt when you eat ?
7. Have you had sore spots underneath your lower complete denture ?
8. Food get under your lower complete denture ?

The answers categorized for all questions:  
Rarely      Fairly      Always

## **RESULTS**

Tables (1) represent descriptive statistics for the tested groups at three different times

Table (1): Descriptive statistics for each group at three different times

Time of radiograph	N	Mean*	Standard Deviation
<b>Group A: Not used prosthesis</b>			
First radiograph	5	2.1100	.37908
After 3 months	5	2.0820	.38141
After 6 months	5	2.0580	.37996
<b>Group B: Conventional heat curing acrylic dentures</b>			
First radiograph	15	2.0133	.19364
After 3 months	15	1.9433	.18184
After 6 months	15	1.8607	.14728
<b>Group C: Dentures with soft acrylic lining material</b>			
First radiograph	15	2.0260	.31332
After 3 months	15	2.0467	.29041
After 6 months	15	2.0227	.29061

\* Mean of bone resorption index.

Whereas tables (2) and (3) demonstrate that there is no statistical difference (at  $p \leq 0.05$ ) in bone resorption index for

the tested groups after 3 months and after 6 months where  $p$ -value = .5286 and .5280 respectively.

Table (2): ANOVA for the tested groups after three months

Variance	Sum of squares	df	Mean square	F-value	P-value
Between groups	2.8118	8	.3499		
Within groups	6.603	96	.0793	.891	.5286
Total	9.414	104			

Table (3): ANOVA for the tested groups after six months

Variance	Sum of squares	df	Mean square	F-value	P-value
Between groups	2.798	8	.34		
Within groups	6.597	96	.0776	.891	.5280
Total	9.395	104			

Tables (4) and (5) demonstrate the answers of the patients about their satisfaction with dentures.

Table (4): Denture Satisfaction for patients wearing conventional acrylic dentures

Questions	Rarely	Fairly	Always
Denture loose on speaking...	(10%)	(55%)	(35%)
Uncomfortable to eat	(25%)	(35%)	(40%)
Denture come loose on eating hard food	(5%)	(75%)	(20%)
Denture come loose on eating soft food	(15%)	(40%)	(45%)
Denture not fit properly	(20%)	(65%)	(15%)
Denture hurts on eating	(45%)	(35%)	(20%)
Sore spots underneath denture	(55%)	(20%)	(25%)
Food under lower denture	(15%)	(30%)	(55%)

Table (5): denture satisfaction for patients wearing dentures with soft lining material

Questions	Rarely	Fairly	Always
<b>Denture loose on speaking...</b>	(48%)	(35%)	(17%)
<b>Uncomfortable to eat</b>	(56.5%)	(30%)	(13%)
<b>Denture come loose on eating hard food</b>	(61%)	(30%)	(9%)
<b>Denture come loose on eating soft food</b>	(83%)	(14%)	(4%)
<b>Denture not fit properly</b>	(65%)	(22%)	(13%)
<b>Denture hurts on eating</b>	(74%)	(13%)	(13%)
<b>Sore spots underneath denture</b>	(74%)	(22%)	(4%)
<b>Food under lower denture</b>	(43%)	(30%)	(26%)

### DISCUSSION

Mandibular bone resorption has challenged prosthodontists for years, in the edentulous ridge progressive resorption increases with age and several factors can affect the rate of resorption of the mandible.<sup>(14)</sup> The results obtained show a generalized decrease in bone resorption index between the patients in the three groups examined and there is a value in the amount of residual ridge resorption between the first, second and the third radiographs for the three groups examined, the highest reduction in bone height was observed in group used hard acrylic denture and the least was in group used dentures lined with acrylic based soft liner, but these results are statistically insignificant, perhaps because of the short period of the study (six months), also the patients in this study have lost their teeth for more than one year and it is well known that most of bone resorption occur during the first year after extraction,<sup>(3)</sup> but lack of statistical significance between the results in this study may not necessarily means that there are no differences between them but this encourage the idea of further research in this area and work needs to be carried out in this field for extended period of time. Applying permanent soft liner to a mandibular complete denture is an effective treatment from the viewpoint of patient preference, most patients seem to have more comfortable dentures and better chewing ability by using soft liners (table 5), and the clinical efficacy of soft denture liners have been reported in previous study,<sup>(15)</sup> this is also in accordance with another study which found that application of soft denture liners to mandibular complete dentures improved masticatory ability of edentulous patients and provided the

patients with dentures with few problems affecting the alveolar ridge compared to hard denture base.<sup>(16)</sup>

### CONCLUSIONS

There is no significant difference between conventional heat curing dentures and dentures lined with acrylic based soft lining material regarding the rate of residual ridge resorption. Regarding denture satisfaction, most patients seem to have more comfortable denture and better chewing ability by using soft liners.

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