

The effect of different base material on patient's satisfaction and microbial accumulation

Enas Taha Darwish

BDS, MSc, PhD, Associate Professor, Department of Removable Prosthodontic, Faculty of Dentistry, National University of Science and Technology, Nasiriya, Iraq, Email: dr_enas81@live.com

Abstract

Statement of problem: Newly wearer complete dentures patients, may showed some discomfort and dissatisfaction during function that result in a bad experience with them. Proliferation of microbial flora is affected by the surface texture and roughness of the fitting surfaces of the complete denture; hence they occur in different percentage relating to different denture base resin. **Aims of the study:** the present study showed and evaluates Candida albicans proliferaton and patient's satisfaction with complete dentures constructed with different denture base materials. **Materials and methods:** thirty patients treated with complete dentures divided into three groups (Group A: received conventional complete dentures constructed of heat cured acrylic resin, Group B: received complete dentures constructed of acrylic dentures with soft acrylic denture flanges and base) and **Group C** having complete dentures with casted metal base. The follow-up period was at delivery, one and three months. Prosthodontic maintenance and follow up required were documented every month. **Results:** Significant differences were observed in the colony counts between the different base materials during the follow up period. **Conclusion:** patients received complete dentures constructed with metallic denture base proved to be effective in decreasing the fungal growth present in complete dentures. Although overt clinical manifestations were not present, colony counts of Candida species were high in the acrylic resin denture bases of these patients. Also, patients with complete dentures constructed with soft acrylic flanges and base were more satisfied than those received conventional complete dentures constructed of heat cured acrylic resin and metal base.

Keyword: conventional complete dentures, different base materials, soft acrylic resin base, Candida albicans, patient's satisfaction.

Introduction

Most of completely edentulous patients require treated with conventional full dentures, in spite of installing dental implants as an advanced treatment plan for completely edentulous patients [1-6]. Metallic denture base constructed either from precious alloys (gold), non- precious metallic alloys (cobalt chromium or Nickel chromium) or non-metallic denture base that are constructed from polymers. The choice of such polymers are based on the irstrength, availability and durability, satisfactory thermal properties, processing accuracy, dimensional and color stability , insolubility and low sorption in oral fluids, absence of taste and odor, biocompatibility, natural appearance, adhesion to plastics, metals and porcelain, and easy of fabrication and repair [8-9] The microbe-flora inside the Human oral plays an important role in maintaining a healthy oral mucosa in normal partially and/or edentulous denture users [10]. These microorganisms are highly diverse containing about 700 bacterial and fungal species of which more than half have not yet been isolated and differentiated [11] the condition of oral denture hygiene is important in regulating oral Candidal carriage have been investigated, denture plaque accumulating on the fitting surface of the denture as a result of poor denture hygiene, acts as a substrate that mediates Candida albicans colonization. Also, traumatic injuries produced by an ill-fitting denture may reduce the tissue resistance against infection and increase permeability of the epithelium to soluble Candidal antigens and toxins [12]. According to berg et al [7], the technical, physiological and biological interaction between the Prosthodontic and the patients play a great role in construction of complete dentures. The majority of patients were satisfied with the stability and retention of their complete dentures; however, some patients are still dissatisfied with this line of treatment [2]. Among the polymer materials introduced in prosthetic dentistry,

Polymethyl methacrylate (PMMA) is the only proven material for a successful denture base on account of its optimal physical properties and excellent esthetics with relatively low toxicity compared to another plastic denture bases. A long-established method for denture processing for acrylic polymer is a closed-flask compressing molding with heat activation in a water bath for resin polymerization. However, polymerization shrinkage of the resin and distortion of the denture base due to thermal stress is virtually unavoidable during the processing of dentures. These adverse effects cause movement of the artificial teeth position and increase the gap between the denture base and underlying mucosa, resulting in an ill-fitting denture. It has been suggested that an accurate fitting is a key factor in the physical mechanisms of complete denture retention [11]. Vertex RS resin (Vertex, Zeist, Netherlands), is a soft acrylic material that can be used as denture flanges and base. The Vertex resin showed a great adaptation to the underlying tissues due to the decreased polymerization changes which leads to a decreased gap between the denture base and the underlying tissues especially at the mid-palatal portion of the upper denture increasing the retention of the complete denture [12]. Patients' evaluations of their removable prosthesis sometimes neither correlate with the clinicians' assessments nor with anatomic factors [3-4]. Evaluation of patients' satisfaction with their complete denture is limited by various methods used in collecting and rating all the influential factors [5-8], such as rate and total number of corrections after insertion, psychological and mental characteristics of patients, self-evaluation of affective state or of quality of life, demographic and socioeconomic factors (e.g., age, gender, level of education, level of income, trans cultural differences), patient further expectation of dentures, quality of denture construction, occlusal factors, anatomic and physiologic characteristics of the patient (e.g., quantity of alveolar ridge resorption, quality and quantity of saliva, tongue hypertrophy, status of oral mucosa, quality of denture-bearing area). According to Berg [7], Sato (9), and Van der Waas [10], several authors suggested seven criteria as the most important factors in assessing patient satisfaction with complete denture therapy. The aim of this study is to evaluate patient's satisfaction and accumulation of *Candida albicans* of three different techniques of denture base materials.

Materials and methods

The study was carried out in the Department of Removable Prosthodontic, National University of Science and Technology, Nasiriya. The population of this clinical study constituted of 30 patients (17male, 13 female) who have been treated with complete dentures. The age of the patients ranged between 40 and 65 years with a mean age of 54 years. The basic inclusion criteria were completely edentulous patients require treatment with complete dentures. While exclusion criteria were with Patients receiving or with history of chemotherapy, radiotherapy, hormonal therapy or taken any kind of medical treatments, severe ridge resorption and those with severe bony undercuts or bony exostosis, also, the covering mucosa was free from any signs of inflammation or ulceration. The patients agreed with a written informed consent. The study was conducted in accordance with the Helsinki Declaration of 1975 for medical studies, as revised in 2000. Patients were chosen with taken into consideration that they wear the complete dentures for the first time, and they should be constructed at least four months after last tooth extraction. Patients were divided into three groups, Group Received complete dentures with a hard heat cured acrylic; Group B received complete dentures with a soft acrylic resin in base and flanges, group C utilizing complete denture with metallic denture base. Conventional acrylic resin complete denture construction process were done for all groups, starting with upper and lower primary impressions taking using irreversible hydrocolloid impression material. The primary

impression was poured to construct study casts. Self-cure acrylic resin special trays were constructed on the primary casts then secondary impression using elastomeric impression material were made, then poured to construct the master casts. Occlusion blocks were constructed over the master casts, and then Centric occluding relation was recorded with predetermined vertical dimension. Maxillary cast was mounted according to maxillary face bow record, while the lower cast was mounted according to the centric relation record on a fixed condylar path articulator. Setting up of teeth was carried out using cross linked flat cusped acrylic teeth following the monoplane occlusion principle, then waxing up was done as usual. The accuracy of vertical dimension, centric relation, phonetics and esthetics were checked in the try-in of waxed up dentures. The dentures for Group A were processed using heat cured acrylic resins following long curing cycle, 8 hours in 160°. For Group B, Fabrication of complete dentures with soft acrylic flanges and base were under consideration of some technical specifications, starting by mixing ratio by volume/parts by weight 1ml/1.2 g liquid(monomer)-1.2 g powder (polymer) for 30 sec., Dough time was 15 min., then working time at 22c° lasts for about 22 min., Start curing process in cold water and increase water temperature, then maintain the water temperature for a while then stop curing with air cooling to ambient temperature, the curing process lasts for about 120 min. till end and starting polymerization process, figure (1).

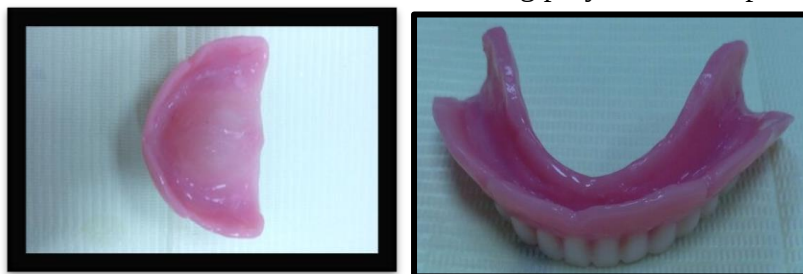


Figure (1): Soft acrylic (Vertex) complete denture

For Group C utilizing metallic denture base, after taking the primary and final impression, the final cast derived from this impression was duplicated and refractory cast was formed. A sheet of green spacer wax was adapted on the palatal portion of the refractory cast covering the crest of the ridge and extending 2-3 mm beyond it. 2-3 mm length of a loop made of wax was attached to the peripheral border of the previously adapted palatal spacer wax. It was taken care that all these loops were 2-3 mm short of the sulcus. These loops would enhance the interlocking of acrylic. This was important because no loop should interfere with the acrylic border of the denture extending into the sulcus. Tiny loops were placed slightly palatal to the crest. The height of these loops was such that it would not interfere with the arrangement of artificial teeth but was sufficient enough for inflow of acrylic resin. A butt joint was created palatal to the crest at the junction of acrylic and metal that enhances the strength of the metal acrylic junction creates a smooth joining of acrylic with metal avoiding any step formation, thus making it comfortable for the patient. For making the butt joint, a 2-mm cylindrical blue wax beading was adapted palatal to the crest of the ridge. A bard parker knife was run 45° to the border of the bead. Once the design of the palate in wax was done, wax sprues were attached and casting was done. The metal palate after finishing was placed now on the master cast and occlusion rim was made for jaw relations. The jaw relations were recorded and teeth arrangement was done. After curing, the metal denture was finished and polished. At delivery, patients were instructed for proper denture hygiene, not to wear dentures during sleeping hours and to keep it in tap water, clean the dentures after each meal under tap water only, not to use any mouth washes or denture cleansers during the study period. They were also instructed not to use any denture adhesives.

Patients' satisfaction

The patients were recalled for post insertion care and follow-up period, denture adjustment and a questionnaire were taken for all groups once every week for one month, then once every month for three months.

Microbiological evaluation

The oral microbial flora changes evaluated at time of delivery, after 1 month, and after 3 months. The samples were collected in the morning hours between 10-12 O'clock giving chance for the patients to use the dentures several hours before taking the swabs. Patients were instructed not to eat any food before taking the swabs. The swab was taken from the fitting surface of the denture base using sterile swab. The swabs were taken from each patient in the following intervals:

- First swab, at delivery time.
- Second swab, one week later.
- Third swab, two weeks later.
- Fourth swab, three weeks later
- Fifth swab, four weeks later.

In this study, three Petri dishes were used for every single swab. One Petri dish for the hard cured acrylic denture swap, the other one for the soft dentures swap, and one for metallic complete denture base, Petri dishes were containing sabouraud's agar media, the swabs taken at delivery was considered as a control for each patient. The swab was heavily seeded to give a "Well" on one quadrant of the plate by rotating the swab and sweeping over the surface several times, secondary and successive dilutions strokes were made by a sterile loop. The wire loop was sterilized using the Bunsen flame so that the whole length became red-hot, then it was left to cool and was drawn from the Well into three parallel lines on to the fresh surface of the medium and this process was repeated.

Aerobic culturing

Petri dishes for each patient containing Sabouraud's agar media, were incubated in an electrical incubator adjusted at 37°C for 48 hours.

After incubation, the plates were checked for the presence of growth and evaluated semi-quantitatively using the method of **Collee et al 1996 [11]** as follows:

- No growth: if no growth was detected on the line of streaking.
- Light growth: where growth occurred on the first line of streaking.
- Moderate growth: where growth occurred on the first and second lines of streaking.

Heavy growth: where growth occurred in the first, second and third lines of streaking.

Different cultures were described for the shape and color of their colonies. The colonies were identified under the microscope according to direct smear technique previously described by Brooks et al. 1991 [12] and Marsh and Martin 1999 [13] using Gram stain, figure (2).

Germ tube test

A colony of the yeast was touched lightly by the loop and the yeast cells were emulsified in 0.5 ml of serum in a small test tube with loose cotton wool plug and incubated at 37°C for 2-4 hours. Formation of pseudo-germ in serum confirmed the presence of *Candida albicans*.

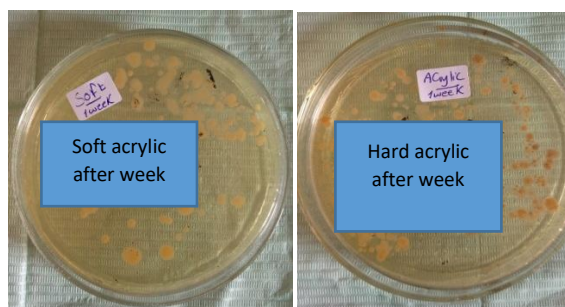


Figure (2): Petri dishes showing the difference in growth percentage for *Candida albicans* after one week

Patient satisfaction questionnaire were taken from all group, based on a visual analogue scale (VAS), in which the patients gave their answers as a crossed mark on a scale from 0 to 100 (low/worst to high/best).

Questions were asked twice for both the upper and the lower dentures:

Scales of Denture Complaints Constructed

Maxillary denture:	Maxillary denture loosens while speaking.
	Maxillary denture loosens while eating
	Maxillary denture hurts while eating hard food types.
	Burning sensation under maxillary denture.
Mandibular denture:	Mandibular denture loosens while eating.
	Mandibular denture loosens while speaking.
	Mandibular denture hurts while eating hard food types
	Burning sensation under mandibular denture
General:	Dry mouth
	difficulty with chewing
	maxillary and mandibular dentures teeth make contact while speaking
	Nervousness because of the dentures.
Physiognomy:	Lip fallen in.
	Cheeks fallen in.
	Mouth fallen in.
Neutral space:	Tongue has too little space.
	I bite my tongue.
	I bite my cheeks.
	I bite my lip.
Esthetics:	Teeth are too large.
	Teeth are too white.
	You don't see enough teeth.
	Teeth are not positioned the way I would like them to be.

Q1: does the denture loosen while eating?

Q2: does the denture loosen while speaking?

Q3: does it hurt while eating hard food (nuts)?

Q4: any feeling of burning sensation under the upper denture (with acrylic denture)

General questions:

Q1: Do the dentures make any difficulty during chewing?

Q2: any feeling of dry mouth?

Q3: any clicking while speaking?

Q4: do you feel nervous because of the denture (with acrylic dentures)?

Q5: which of them feels heavy?

Questions about the physiognomy:

Lip, cheeks or mouth has fallen in?

Questions about neutral spaces:

Q1: does the tongue have too little space?

Q2: does there tongue, cheek or lip biting?

Questions about esthetics:

All data were collected, tabulated and statistically analyzed.

Results

Data were presented as mean & standard deviation. Data were presented in 2 tables & 2 graphs. Statistical analysis was performed with SPSS 16 ® (Statistical Package for Scientific Studies), Graph pad prism & windows excel.

Patient satisfaction

Comparison between three different materials was performed by using One Way ANOVA test which revealed significant difference between all of them as $P < 0.05$, followed by Tukey's Post Hoc test for multiple comparisons which revealed significant difference in means with different superscript letters as $P < 0.05$, while revealed insignificant difference in means with the same superscript letters as $P > 0.05$ (conventional heat cured acrylic resin was significantly the lowest mean in all questions & casted metal base was significantly the highest mean in all questions) as presented in table (1) and figure (3).

Candida albicans colonization

The Candida Albicans count data obtained were expressed as $\log(\text{CFU}+1)/\text{mL}$. Comparison between three different materials was performed by using One Way ANOVA test which revealed significant difference among all follow up periods as $P < 0.05$, followed by Tukey's Post hoc Test for multiple comparisons which revealed significant difference in means with different small superscript letters as $P < 0.05$ (all groups after 1 week & 3 weeks & 4 weeks/casted base metal & other groups after 2 weeks). Also, comparison between different follow up periods within each material was performed by using One Way ANOVA test which revealed significant difference among all follow up periods as $P < 0.05$, followed by Tukey's Post hoc Test for multiple comparisons which revealed significant difference in means with different capital superscript letters as $P < 0.05$ (after 1 week & all others except after 2 weeks - all periods in conventional denture/after 3 weeks & all others - after 4 weeks & all other - after 3 months & all others) as presented in table (2) and figure (4), table (1): Distribution of visual analogue scale on frequently asked parameters as means and standard deviations

Table (1): Comparison between three types of denture base regarding patient satisfaction

Frequently asked parameters	N	Conventional heat cured	Soft Resin	Acrylic	Casted metal base	p value
-----------------------------	---	-------------------------	------------	---------	-------------------	---------

			acrylic resin						
			M	SD	M	SD	M	SD	
Functional	Loosening upon eating	10	6 ^a	1.2	8 ^{ab}	2.6	9.1 ^b	1.5	0.003*
	Loosening upon speaking	10	6 ^a	1.4	6 ^a	0.8	8.28 ^b	1.4	0.004*
	Hurt during chewing hard food	10	6 ^a	0.93	10 ^b	3.3	9.27 ^b	1.4	0.007*
	Burning sensation under denture	10	6 ^a	0.83	9 ^b	2.13	8.85 ^b	1.5	0.001*
Patient related	Dry mouth	10	7 ^a	2.3	10 ^b	3.25	9 ^b	1.1	0.002*
	Difficult chewing	10	7 ^a	1.1	9 ^b	2.66	9 ^b	1.2	0.02*
Nervous because of dentures		10	2.1 ^a	0.4	1.8 ^a	0.3	8.2 ^b	1.2	0.001*
Heaviness		10	6.2 ^a	0.7	2.54 ^b	0.9	8 ^c	1.3	0.0001*
Physiognomy		10	7.2 ^a	1.7	6 ^{ab}	1.2	8.3 ^b	2	0.01*

M: mean SD: standard deviation.

*Significant difference.

Mean with the same superscript letters were insignificantly different as $P > 0.05$.Mean with different superscript letters were significantly different as $P < 0.05$.

Table (2): Comparison between three types of denture base regarding Candida albicans colonization

follow up	Conventional Denture Base		Soft Denture Base		Casted Base Metal Denture Base		p value
	M	SD	M	SD	M	SD	
One Week After	3.9 ^{aA}	0.21	2.16 ^{bA}	0.31	0.94 ^{cA}	0.12	0.0001*
Two Weeks After	7.33 ^{aB}	1.1	6.44 ^{aA}	1.3	1.03 ^{bB}	0.16	0.0001*
Three Weeks After	12.84 ^{aC}	2.34	9.5 ^{bB}	1.2	1.77 ^{cB}	0.33	0.0001*
Four Weeks After	19.2 ^{aD}	2.67	11.8 ^{bC}	2.3	2.01 ^{cB}	0.74	0.0001*
3 months After	27 ^{aE}	3.2	21 ^{bD}	2.8	9.5 ^{cC}	1.3	0.0001*
p value	0.0001*		0.0001*		0.0001*		

M: mean SD: standard deviation.

*Significant difference.

Mean with the same superscript letters (small in row & capital in column) were insignificantly different.

Mean with different superscript letters (small in row & capital in column) were significantly different.

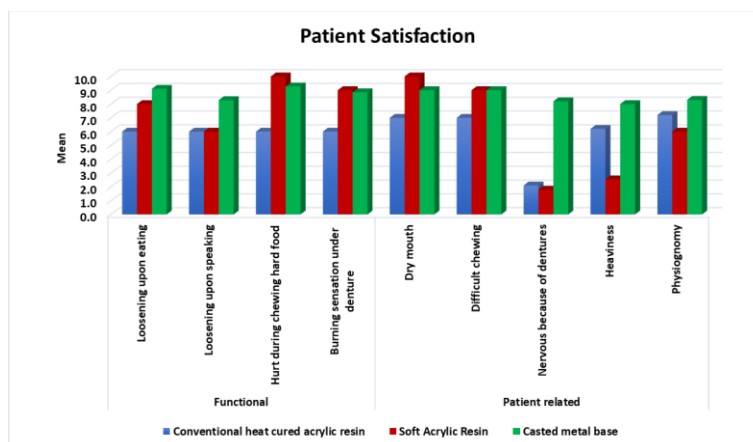


Figure (3): Bar chart represents patient satisfaction of three groups

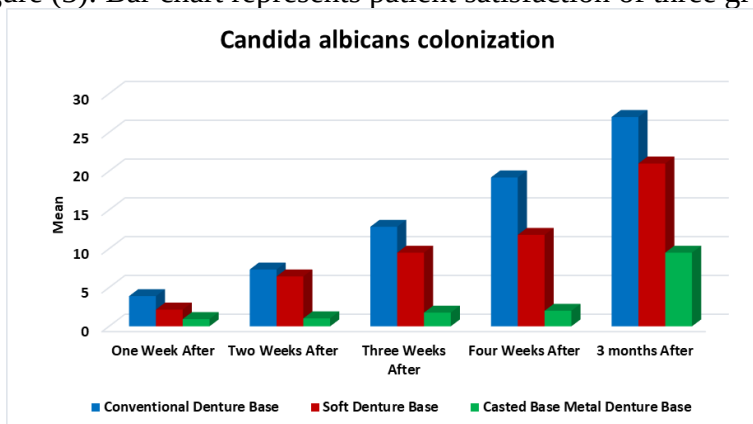


Figure (4): Bar chart represents Candida Albicans colonization among three groups

Discussion

This study was conducted to compare the outcomes of two different techniques for denture construction. One group received complete denture constructed with conventional heat cured acrylic resin while the second group received a soft acryl flanges and base complete dentures. This made patient selection very critical to prevent the influence of the other factors on denture retention. This was crucial for the reliability and validity of the results. To exclude the effect of mechanical factors, patients having ridges with undercut areas were not included. To eliminate the effect of salivary factors, patients with Xerostomia or excessive salivation⁽¹³⁾ and patients undertaking medications that affect salivary flow (e.g. diuretics) [14] were excluded. Similarly, patients with systemic diseases that may affect amount or consistency of saliva (e.g. uncontrolled diabetes mellitus.... etc.) were excluded. For most of the previously mentioned reasons, patients older than 65 years were not included, to eliminate the effect of senility. Senile patients usually suffer from muscle atrophy, decreased neuromuscular coordination, stomatitis, as well as, age related limited manual dexterity [15]. In this study soft acryl shows a significant satisfaction in all the points of satisfaction evaluated except for loosening upon speaking, clicking, nervousness and physiognomy and these results is due to the increased retention due to the decreased gap formed by the soft acryl and the underlying tissue as revealed and investigated in research work stated that the Vertex acryl showed an increased adaptation to the underlying tissues [12]. These results coincide with the clinical studies/observations reached by Jackson AD (1998) [16], Frejlich S, Dirckx JJ (1989) [17], Baemmert RJ (1990) [18], Jackson AD (1993) [19], Chung-Jae

LEE (2010) [12], They all concluded that the usage of soft acryl technique plays a great role in attaining complete denture retention, providing a maintained peripheral seal and a comfortable base.

Conclusion

This investigation showed that patients receiving complete dentures constructed with soft acrylic flanges are better than the traditional complete denture in every respect from a patient's point of view. For completely edentulous patients, complete dentures constructed with soft acrylic flanges can be recommended as a viable option. Hard Heat cure Polymethyl methacrylate denture base resins showed more adherence of Candida cells compared to metal base and/or soft acrylic cure resins, so it can be concluded that the use of soft denture bases for completely edentulous patients would be much comfort, satisfied and retained in addition to less dentures stomatitis occurrence.

References

1. Mazurat N.M. and Mazurat R.D. Discuss before fabricating: communicating the realities of partial denture therapy. Part I: patient expectations. J. Can. Dent. Assoc., 2003; 69:90.
2. Albaker AM: The oral health-related quality of life in edentulous patients treated with conventional complete dentures. Gerodontology. 2013 Mar; 30(1):61-6
3. Ozdemir AK, Ozdemir HD, Polat NT, Turgut M, Sezer H: The effect of personality type on denture satisfaction. Int J Prosthodont. 2006 Jul-Aug; 19(4):364-70.
4. Al Quran F, Clifford T, Cooper C, and Lamey PJ: Influence of psychological factors on the acceptance of complete dentures. Gerodontology. 2001 Jul; 18(1):35-40.
5. Guckes AD, Smith DE, Swoope CC: Counselling and related factors influencing satisfaction with dentures. Guckes AD, Smith DE, Swoope CC J Prosthetic Dent. 1978 Mar; 39(3):259-67
6. Nazliel HE, Hersek N, Ozbek M, Karaagaoglu E: Oral health status in a group of the elderly population residing at home. Gerodontology. 2012 Jun; 29(2): e761-7.
7. Einar Berg and Reidun Ingebrigtsen: Some attitudes towards edentulousness, complete dentures, and cooperation with the dentist; A study of denture patients attending a dental school. Acta Odontology Scandinavica, 2009, 24(6); 333-338.
8. Margaret C. O. Nuñez, Donizete C. Silva, Bento A. Barcelos and Claudio R. Leles: Patient satisfaction and oral health-related quality of life after treatment with traditional and implied protocols for complete denture construction Gerodontology 2013; Sep; 33(1):1-7.
9. Sato Y, Hamada S, Akagawa Y, Tsuga K.: A method for quantifying overall satisfaction of complete denture patients. J Oral Rehabil.. 2000; 27:952-957.
10. Van der Waas MAJ. The influence of psychologic factors on patient. Satisfaction with complete dentures. J Prosthetic Dent. 1990; 63:545-548.
11. Darvell BW, Clark RK. The physical mechanisms of complete denture retention. Br Dent J 2000; 189: 248-252.
12. Chung-Jae LEE, Sung-Bem BOK, Ji-Young BAE and Hae-Hyoung LEE. Comparative adaptation accuracy of acrylic denture bases evaluated by two different methods. Dent Mater J 2010; 29(4): 411–417
13. Turner M.: J. Am. Dent. Assoc., 2008; 139(2): 146.

14. Green A.J.: Influence of diuretics on complete denture retention. *J. Prosth. Dent.* 1980; 43(5): 506.
15. John R., Ivanhoe N. and Roman M.: Treating the modern complete denture patient. *J. Prosth. Dent.*, 2002; 88: 631.
16. Jackson AD, Grisius RJ, Fenster RK, Lang BR. Dimensional accuracy of two denture base processing methods. *Int J Prosthodont* 1989; 2: 421-428.
17. Frejlich S, Dirckx JJ, Goodacre CJ, Swartz ML, Andres CJ. Moire topography for measuring the dimensional accuracy of resin complete denture bases. *Int J Prosthodont* 1989; 2: 272-279.
18. Baemmert RJ, Lang BR, Barco MT, Jr., Billy EJ. Effects of denture teeth on the dimensional accuracy of acrylic resin denture bases. *Int J Prosthodont* 1990; 3: 528-537.
19. Jackson AD, Lang BR, Wang RF. The influence of teeth on denture base processing accuracy. *Int J Prosthodont* 1993; 6: 333-340.