ORIGINAL RESEARCH PAPER | Dental Science | Volume : 6 | Issue : 12 | December 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

A Study to Evaluate the Dimensional Accuracy of Heat Cure Acrylic Complete Denture After Relining and Rebasing Using Closed Mouth Technique

KEYWORDS: Reline, rebase, dimensional accuracy ,heat cure resin.

Prof. (Dr.) Manoj Shetty	Dr. Nivya John	Dr. Bharathraj Shetty
Head Of The Department Of Oral Implantology, MDS, A.B.Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore, India.	Lecturer, Department of Oral Implantology,MDS, A.B.Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore, India	Reader, Department Of Prosthodontics Including Crown And Bridge, A.B.Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore, India

Prof. (Dr.) Krishna Prasad D	Prof.(Dr.) Chethan Hegde
Professor ,Department Of Prosthodontics Including Crown And Bridge, A.B.Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore, India	Head Of The Department ,MDS ,Department Of Prosthodontics Including Crown And Bridge, A.B.Shetty Memorial Institute of Dental Sciences, ,Deralakatte, Mangalore,India

ABSTRACT *Various physical changes causes alterations in the fit of the denture. Since most of the recipients of the complete denture prosthesis are the geriatric population,a time saving procedure is paramount for the satisfaction of the patient. Thus the need for dimensionally accurate relining and rebasing was established . This study estimates the changes in the linear dimensions of 28 dentures before and after relining and rebasing. Two groups with 14 dentures each for relining and rebasing were selected .Pre reline and pre-rebase measurements were recorded .Impressions were recorded using closed mouth technique. Post reline and post rebase measurements were recorded. The collected data was statistically compared and analyzed. Statistically significant variation was seen in change of dimensions comparing reline and rebase. The dimensional differences between pre and post reline/rebase did not hinder the attained support and retention of the denture. Relined and rebased dentures had negligible variations.*

INTRODUCTION:

Utilization of Complete denture prosthesis is one of the complex procedures in the prosthetic practice. Different materials have evolved over the ages which are used in the fabrication of dentures. Although latest trends have emerged, use of acrylic complete dentures is still very substantial especially in the developing backward population. A critical part of complete denture is the adaptation of the impression surfaces to the mucosa over the ridges. Various factors come into play while fabricating a well fitted denture. These include the host factors (ridge), materials used and the technique incorporated. Various systemic conditions and the physiological resorption that take place in aging patients also determines the success of the complete dentures.

The dynamic property of the above mentioned factors leads to the changes in the fit of the denture. Since most of the recipients of the complete denture prosthesis are the geriatric population , a time saving procedure is paramount for the satisfaction of the patient. Thus the need for relining and rebasing was established.Relining and rebasing are methods used to modify the impression surface of the existing denture. Relining is the process by which the fitting surface or impression surface is trimmed and lined with a new surface material. There are various techniques which include chair side reline or relining with heat cure acrylic which is more durable. Rebasing is the process by which the entire base material is removed except for the teeth and replaced with a new denture material.(1)

These methods have rendered improvement of the denture retention with minimal chair side time. This will reduce the number of steps in fabrication and take few appointments for the same. The dimensional accuracy of the relined/rebased denture is critical. Changes in the dimensions must be minimal so as to provide a good denture adaptation. The dimensional alterations occur due to improper case selection, inefficient technique and processing errors. (2)

The significance of this dimensional irregularities thus must be evaluated to substantiate these methods.

Source of the data: The study includes twenty eight complete dentures from patients visiting out-patient department of Prosthodontics and Crown and Bridge in A.B.Shetty Memorial Institute of Dental Sciences (Nitte University), Deralakatte, Mangalore. Informed consent to participate in the study was obtained from each subject.

Inclusion criteria:Ill fitting dentures with good occlusion were chosen.Healthy oral tissue with no loss of vertical dimension of the face was primely chosen

Exclusion criteria: Highly worn out denture with severe loss of function and esthetics.

Materials used:

For the Clinical procedures the following materials were used: Green stick compound,Zinc oxide eugenol impression paste(DPI),Modelling wax, Articulator, Bard Parker blade and Hematoxilin pencils

For the laboratory procedures the following materials were used: Heat cure acrylic powder and liquid.

Volume : 6 | Issue : 12 | December 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

(Trevalon),Hydraulic press, Flasks, Assorted acrylic burs ,Articulating paper(Bausch 40um)

For Photography :D-SLR camera Canon EOS 1100 D, Canon EF 100 mm f/2.8L Macro IS USM Lens

Meaurements: MOTIC software supported by MOTIC light microscope was used to measure the specimens as a latest alternative.

Methodology:
Group 1 (Control) : Measurements of dentures prior to repolymerization.This group included 28 complete dentures.

Group 2(Study):This group was further divided into two subgroups.

Sub group 'a' :14 complete dentures were measured after relining.

Sub group 'b': 14 complete dentures were measured after rebasing.

Lab Procedures:
Relining (indirect method)

Denture preparation for relining procedure : The ill fitting maxillary and mandibular dentures were prepared by relieving all large undercuts and by relieving 1.5-2mm from the tissue surface. The borders were reduced to 1-2mm. (Fig 1)

FIGURE 1 : Relieved mandibular denture.
A wash impression was made on the fitting surface of the denture with impression paste,with the patient in light occlusal contact.(Fig 2) It was then followed by heat cure acrylisation by Compression Moulding Technique.(3)

FIGURE 2 wash impression made with zinc oxide eugenol.:

Since this was a denture which was undergoing a second processing cycle, care must be taken to cause minimal stress induction due to sudden raise in temperature.(fig 3)

FIGURE 3: Wash impression invested and flasked.
After the curing cycle the flasks were removed from the water bath and slowly bench cooled to room temperature for 30 minutes. Subsequently the flasks were immersed in water for 15 minutes. This was done in order reduce the internal stresses that are formed during cooling. A study done by Kimoto et al suggested that bench cooling reduced the strain caused by thermal shrinkage during the denture processing.(4)

Post –polymerization Denture preparation : Pressure areas on the tissue surface of the denture was relieved. Minor occlusal disharmony was corrected by selective grinding using articulating paper (Bausch 40um).Small border inadequacies were corrected.

Rebasing: This technique is same as for the reline except in the laboratory the palate was removed and new denture base material was packed.(fig 4)

FIGURE 4: Denture base removed leaving behing only the teeth in rebasing.

Measurements:
The pre-reline and pre-rebase acrylic dentures were marked with three crosses with number 15 scalpel blade at the incisal edges of central incisors(A),disto-palatal cusps of the second molars of maxillary teeth and disto-buccal cusps of the second molars of mandibular teeth (B,C) .The distances between the crosses AB,BC,CA measured using high resolution optical alternative called the MOTIC optical microscope. The distances of pre and post polymerization dentures were then measured(fig 5a and b)

Volume : 6 | Issue : 12 | December 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

FIGURE 5a: lines joining incisal edges and the disto buccal points in mandibular denture

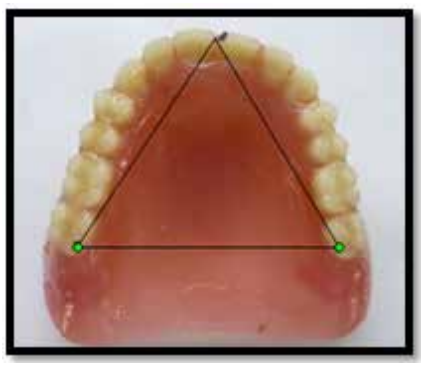

Figure 5b : lines joining the incisal edge and the disto palatal cus points in maxillary denture.

Results:

TABLE 1: Comparison of dimensional differences of heat cure acrylic dentures before and after rebasing and relining

Group	Parameter		N	Mean	SD	Mean Difference	95% CI of the Difference		T	df	p-value
							Lower	Upper			
REBASING	AB	Before	14	1281.89	222.65	23.91	13.75	34.06	5.09	13	<0.001*
		After	14	1257.98	217.55						
	BC	Before	14	1315.30	176.30	29.24	18.10	40.39	5.67	13	<0.001*
		After	14	1286.06	165.56						
	AC	Before	14	1296.39	202.01	16.34	1.79	30.89	2.43	13	0.03*
		After	14	1280.05	205.44						
RELINING	AB	Before	14	1153.46	248.38	10.78	8.06	13.50	8.56	13	<0.001*
		After	14	1142.69	249.58						
	BC	Before	14	1271.57	220.96	9.78	6.80	12.76	7.09	13	<0.001*
		After	14	1261.79	223.51						
	AC	Before	14	1165.23	236.14	11.44	8.17	14.71	7.56	13	<0.001*
		After	14	1153.79	237.45						

Paired t test: *p,0.05 statistically significant , p>0.05 non significant ,NS

TABLE 2: Comparison of dimensional differences of rebased and relined dentures.

Study parameter		N	Mean	SD	Mean Difference	95% CI of the Difference		U Statistic	p-value
						Lower	Upper		
AB	REBASING	14	-23.91	17.58	-13.13	-23.51	-2.75	46.50	0.02*
	RELINING	14	-10.78	4.71					
BC	REBASING	14	-29.24	19.30	-19.46	-30.86	-8.07	25.50	0.001*
	RELINING	14	-9.78	5.16					
AC	REBASING	14	-16.34	25.20	-4.90	-19.67	9.87	82.000	0.46 (NS)
	RELINING	14	-11.44	5.66					

Mann Whitney U test : *P<0.05 statistically significant ,p>0.05 non significant, NS

Volume : 6 | Issue : 12 | December 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

DISCUSSION:

Table 1 presents a comparison of results between rebasing and relining. Here paired t test has been used to analyse the data and the result is considered significant if p> 0.05 .Under rebasing the differences of the mean dimensions between the points, AB ,BC,AC before and after rebasing were analysed. The mean difference for AB,BC,AC were 23.91 ,29.24 ,16.34 respectively. Significant results were found with p<0.001 for AB and BC and non significant results were seen with p=0.03.

Under relining the differences of the mean dimensions between the measurement points, AB ,BC,AC before and after rebasing were analysed. The mean difference for AB,BC,AC were 10.78,9.78 and 11.44 respectively. Significant results were found for AB,BC and AC with p<0.001The values showed significant change in all the measurements of reline and rebase. There was a significant dimensional change with p=0.001 for all the measurements except for AC in reline.

Table 2 shows the comparison of dimensional difference between relined and rebased dentures. The results was assessed using Man Whitney test. The analysis represents the change among the measurements AB,BC and AC after relining and rebasing .The measurement AB ,BC and AC after rebasing showed a mean difference of -13.13,-19.46 and -4.9 respectively. There was significant difference with p=0.02 and 0.001 for AB, BC (post rebase and reline) respectively. Non significant values were seen in AC with p-0.46.

Boucher explains that the purpose of Relining process is to fill the space between the tissue and the denture base without changing the position of the teeth and relation of the dentures.(5)Winkler suggests the use of rebasing to avoid fabrication of thick palate that tends to happen with several relines. (1)Relining can be done by direct method where in the dentist use chair side reline material including cold cure denture material and tissue conditioners. These methods are fast but the patients return to the clinics after a short duration as these materials wear easily.

Indirect method is the process by which a wash impression is made in the trimmed surface and that is replaced by heat cure acrylic resin. Dental polymer used in the reline has shown to be susceptible to hygroscopic and hydrolytic effects. A review done by Jack et al summarizes these effects on dental polymer resins which can bring about dimensional errors in a processed denture. The extent to which these phenomena effect the clinical performance have to further investigated.(6)and to review the literature generated over the past thirty years or more in this area. Information was gathered from nearly 90 published articles or abstracts appearing in the dental and polymer literature. Studies were predominantly identified through a search of the PubMED database. Studies were included that provided direct evidence for the uptake of solvent by a polymer network and its subsequent physical or chemical effect, or the loss of molecular species into solvents. An attempt was made to select articles that spanned the timeframe from approximately 1970 to today to ensure that most of the classic literature as well as the latest information was included. Dental polymer networks have been shown to be susceptible to hygroscopic and hydrolytic effects to varying extents dependent upon their chemistry and structure. The importance of these effects on the clinical performance of polymer restoratives is largely unknown, though numerous investigators have alluded to the potential for reduced service lives. While the physical and mechanical properties of these materials may be significantly altered by the effects of solvent uptake and component elution, what may constitute the greatest concern is the short-term release of unreacted components and the long-term elution of degradation products in the oral cavity, both of which should be strongly considered during restorative material development.

Lung et al stated that heat cure acrylic release less residual monomer than cold cure and that inorder to get negligible biological and mechanical effects,the value of residual monomer in the processed denture must be kept to a minimum.(7)and whether optimum conditions could be identified. Denture bases were processed following normal laboratory procedures, including pre-cure for 3 h at with increasing time at temperature, but did not approach equilibrium. The rate of diffusive loss of MMA appears to exceed the rate of depolymerization. Residual monomer is inevitable for all PMMA-based products no matter what the curing conditions are. However, extended time at high temperature can allow low values to be attained, and the time allowed can compensate for processing temperatures somewhat lower than the ordinarily recommended

Chow et al stated that during processing of the denture, the heat-cured resins gets heated to a temperature which is more than the glass transition temperature.An internal stress is stored up within the resin on cooling from the maximum temperature to the glass transition temperature. Further cooling results in thermal shrinkage.(8)adjustments may be required because of dimensional change that occurs during reprocessing of the denture when new denture base material is polymerized. PURPOSE: This study analyzed the linear dimensional change of heat cured acrylic resin that occurs during reline and rebase procedures for complete dentures. MATERIAL AND METHODS: Twenty-two maxillary and mandibular complete denture bases with artificial teeth were saturated by immersion in distilled water at 37 degrees C +/- 1 degree C. Fine crosses were marked on the incisal edges of the central incisors and the supporting cusps of the second molar teeth. Distances between the marks were measured with a high resolution traveling microscope. Heat-cured acrylic resin was processed by a long curing cycle of 72 degrees C for 6.5 hours, then heated to 100 degrees C for over 30 minutes and kept at 100 degrees C for 1 hour. The relined or rebased denture was allowed to cool slowly in the water bath for 48 hours to reach ambient temperature. The reference-crosses were measured immediately after careful deflasking. RESULTS: In the relining procedure, all incisor-molar and intermolar distances exhibited shrinkage of 0.3%, despite different shapes of maxillary and mandibular dentures. Results of the rebasing procedure were similar to that of the reline expect that only 0.1% intermolar shrinkage was found on the maxillary denture. CONCLUSION: Shrinkage was approximately 0.15 mm for an interarch distance of 50 mm. This degree of change is both clinically undetectable and insignificant. Using this processing cycle for acrylic resin in reline or rebase procedures did not cause clinically significant dimensional changes to complete dentures.The denture base resin is surrounded by a rigid dental stone during flasking, the contractions of both these materials is different ,thereby causing yield stresses within the resin.Various studies have been done to combat these discrepancies.

Kimoto et al suggested that bench cooling is very advantageous to relax the stresses that are induced by thermal

Volume : 6 | Issue : 12 | December 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 79.96

shrinkage. He suggested that the flasks must be slowly cooled to room temperature to achieve the same.Takamata explained in his studythat when there is greater contact between the surface of the denture base and the tissue there will better adaptation of denture to the oral tissue.(9)

Chow et al in his study had comparable results of linear dimensional change of -0.3 it was also stated that dimensional change in the dentures was not responsible for inducing occlusal errors during the reline procedure. (8)adjustments may be required because of dimensional change that occurs during reprocessing of the denture when new denture base material is polymerized. PURPOSE: This study analyzed the linear dimensional change of heat cured acrylic resin that occurs during reline and rebase procedures for complete dentures. MATERIAL AND METHODS: Twenty-two maxillary and mandibular complete denture bases with artificial teeth were saturated by immersion in distilled water at 37 degrees C +/- 1 degree C. Fine crosses were marked on the incisal edges of the central incisors and the supporting cusps of the second molar teeth. Distances between the marks were measured with a high resolution traveling microscope. Heat-cured acrylic resin was processed by a long curing cycle of 72 degrees C for 6.5 hours, then heated to 100 degrees C for over 30 minutes and kept at 100 degrees C for 1 hour. The relined or rebased denture was allowed to cool slowly in the water bath for 48 hours to reach ambient temperature. The reference-crosses were measured immediately after careful deflasking. RESULTS: In the relining procedure, all incisor-molar and intermolar distances exhibited shrinkage of 0.3%, despite different shapes of maxillary and mandibular dentures. Results of the rebasing procedure were similar to that of the reline expect that only 0.1% intermolar shrinkage was found on the maxillary denture. CONCLUSION: Shrinkage was approximately 0.15 mm for an interarch distance of 50 mm. This degree of change is both clinically undetectable and insignificant. Using this processing cycle for acrylic resin in reline or rebase procedures did not cause clinically significant dimensional changes to complete dentures.

Polukusho et al stated that since there is an increase in the volume of newly added resin the shrinkage expected may be greater. The degree of shrinkage was found to be significant with P=0.001 and which was comparable to the results of relining.(10)

There was a significant difference in the measurements between the inter-molar area and right incisor molar measurements. This may be due to fact that in rebase the entire palate was removed. An unexpected finding was that the value on the left incisor –molar area showed no significant difference between the reline and rebase denture. This may be again attributed to the nature of the operator packing methods. Since a single operator did the procedure there was no inter operator errors. After reline or rebase, adjustment of occlusion is imperative because of the dimensional change that occurs during processing. On the contrary another factor governing the change of occlusion is most probably due to differential displacement of dentures during impression making.

Studies have shown that the second processing of the base may result in dimensional changes that may cause loss of fit of the dentures,(11) However this study showed no evidence of such loss and the dentures adapted well. Reline and rebase has thus proven to be a reliable method to reform loose dentures. Although there are minor changes in the dimensions of the relined/rebased dentures the denture fit and adaptation is not compromised.

CONCLUSION:

Within the limitations of the study the following inferences were made:

This study compared the dimensional accuracy of 28 dentures after heat cure relining and rebasing using closed mouth technique.(14 relined and 14 rebased)

The results showed that although there was dimensional variation after the procedure the fit of the denture was not compromised.The dimensional differences between reline and rebase also had variations as more denture base material was used for rebase thus showing more shrinkage, however the variations were negligible considering the fact that the dentures adapted well.

REFERENCES :

1. S. Winkler. Essentials of complete denture prosthodontics.2nd edition.Delhi 2012.
2. Cucci a L, Giampaolo ET, Leonardi P, Vergani CE. Unrestricted linear dimensional changes of two hard chairside reline resins and one heat-curing acrylic resin. J Prosthet Dent. 1996;76(4):414–7.
3. Anusavice KJ. Philips' Science of dental materials. 11 edition. W.B.saunders, editor. St. Louis: W.B.saunders; 2003
4. Kobayashi N, Komiyama O, Kimoto S, Kawara M. Reduction of shrinkage on heat-activated acrylic denture base resin obtaining gradual cooling after processing. J Oral Rehabil. 2004;31(7):710–6.
5. Zarb GA, Bolender CL, Eckert SE et al (eds). Prosthodontic Treatment for Edentulous Patients:Complete Dentures and Implant-Supported Prostheses. St. Louis, Mo:Mosby; 2004. 3-7. p.
6. Ferracane JL. Hygroscopic and hydrolytic effects in dental polymer networks. Dent Mater. 2006;22(3):211–22.
7. Lung CYK, Darvell BW. Minimization of the inevitable residual monomer in denture base acrylic. Dent Mater. 2005;21(12):1119–28.
8. Pow EH, Chow TW, Clark RK. Linear dimensional change of heat-cured acrylic resin complete dentures after reline and rebase. J Prosthet Dent. 1998;80(2):238–45.
9. Takamata T, Setcos JC. Resin denture bases: review of accuracy and methods of polymerization. Int J Prosthodont. 1989;2(6):555–62.
10. Polukoshko KM, Brudvik JS, Nicholls JI, Smith DE. Evaluation of heat-cured resin bases following the addition of denture teeth using a second heat cure. J Prosthet Dent. 1992;67(4):556–62.
11. Mainieri ET, Boone ME, Potter RH. Tooth movement and dimensional change of denture base materials using two investment methods. J Prosthet Dent. 1980;44(4):368–73.