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Research Article

A COMPARATIVE STUDY OF DIMENSIONAL CHANGES AMONGST TWO COMPRESSION MOLDED AND TWO INJECTION MOLDED DENTURE BASE RESINS

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A B S T R A C T

A long-established method in denture processing for acrylic polymer is the closed-flask compression molding with heat activation in a water bath, for resin polymerization. Alternative methods to conventional compression-molding processing for denture bases have been developed to increase the adaptation of the denture bases and one such method is the injection-molding technique. There is disagreement as to which technique or material is superior in terms of adaptation accuracy.

Aims: The purpose of this study was to evaluate and compare the adaptation accuracy amongst maxillary denture bases processed by using two compression molded and two injection molded heat cure acrylic resin materials.

Methods and Material: A total of 40 denture bases were fabricated over 40 dental stone casts using a standard metal denture base to maintain the uniform thickness. Twenty denture bases were processed by compression molding 10 using SR Triplex Hot and 10 using Lucitone 199. Another twenty denture bases were processed by injection molding, 10 using SR Ivocap and 10 using Lucitone 199 with success injection system. The denture bases were sectioned at three different areas and the gap between the cast and the denture base was measured using stereo microscope at five different areas namely the right and left vestibule, right and left crest and the midline.

Statistical analysis used: SPSS software package for windows (Ver. 19.0 SPSS Inc. IBM Corp). Comparison of data was made using student independent t- test with significance level of $p \leq 0.001$.

Results: The injection molded denture bases displayed better adaptation compared to compression molded denture bases. Within the compression molded resins both materials did not exhibit significant difference in adaptation. Within the injection molded resins the SR Ivocap system showed better adaptation than Lucitone 199 injected with success system. When compression and injection molded Lucitone 199 was compared the injection molded Lucitone 199 showed better adaptation.

Conclusions: The results of the study indicated that the dimensional change which occurred in the denture base was influenced by the resin packing method. From a clinical point of view, there seems to be little advantage of injection molding over compression molding. A relatively better fit of the denture base may be helpful in reducing the initial adaptation period of the denture wearer.

INTRODUCTION

Over the past thirty years, advances in dentistry have principally been happening as a result of scientific research. Of particular note, are progresses in the field of dental materials and a craving towards the practice of evidence based dentistry. Increased media marketing has resulted in enhanced patient awareness and understanding of the treatments offered by dental practitioners and also, as a direct result, increased patient expectations.

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This study was focused on denture base materials, in particular the adaptation accuracy of resin based polymethylmethacrylate (PMMA) materials. Ever since its introduction in 1937, polymethylmethacrylate (PMMA) has become the most commonly used non-metallic denture base material for denture bases. This is mainly due to its favourable, although not ideal characteristics. For a long time, PMMA resin was polymerized using compression molding technique by heating the molded resin in the temperature controlled water bath. One of the key problems associated with PMMA is the polymerization shrinkage exhibited by the material. The injection molding systems have been developed to compensate for this by

continuously injecting PMMA resin at pressure throughout a carefully controlled polymerization procedure. A precise amount of material keeps flowing into the flask to compensate for the acrylic shrinkage.

The retention of a complete denture base is directly related to the adaptation of the base to the supporting oral tissues. Retention is optimized when the interfacial film thickness is reduced and a thin film of saliva exists between the mucosa and the tissue surface of the denture. The force required to dislodge a denture is inversely proportional to the fluid film thickness between the denture and the tissues. The capillary forces of the salivary film are at maximum when the distance between denture surface and the basal seat is at minimum. The loss of adaptation especially in the area of posterior palatal seal can result in loss of peripheral seal. More dimensionally stable and accurate the base, the more intimate the adaptation will be to the oral tissues, there by maximizing retention.

The polymerization shrinkage exhibited by PMMA may lead to imprecise adaptation of the base material to the denture bearing tissues, resulting in a poor border seal and lack of stability of the denture base. Changes to the occlusal form of the denture, may result in inaccuracies in the intercuspal position of the prosthesis, potentially causing further instability and an unsatisfactory result for the patient's foundation tissues. Alternative methods to conventional compression-molding processing for denture bases have been developed to increase the adaptation of the denture bases and one such method is the injection-molding technique. For many years several studies have discussed this issue in detail but there is disagreement as to which technique or material is superior in terms of adaptation accuracy.

The purpose of this study was to evaluate and compare the adaptation accuracy amongst maxillary denture bases processed using two compression molded and two injection molded heat cure acrylic resins.

Objectives of the study

1. To evaluate the adaptation accuracy amongst maxillary denture bases processed using two different heat cure acrylic resins (SR Triplex Hot - Ivoclar Vivadent and Lucitone199 - Dentsply) processed by compression molding technique.
2. To evaluate the adaptation accuracy amongst maxillary denture bases processed using two different heat cure acrylic resins (SR Ivocap- Ivoclar Vivadent and Lucitone199- Success system Dentsply) processed by injection molding technique.
3. To compare the adaptation accuracy of maxillary denture bases processed using compression and injection molding techniques.
4. To compare the adaptation accuracy of maxillary denture bases processed using Lucitone 199 by compression molding and injection molding techniques.

Null Hypothesis

1. There is no significant difference in the adaptation level of the denture bases fabricated by the two materials- SR Triplex Hot and Lucitone 199, when they are processed by compression molding technique.
2. There is no significant difference in the adaptation level of the denture bases fabricated by the two materials -SR Ivocap and Lucitone 199, when they are processed by Injection molding technique.
3. There is no significant difference in the adaptation level of the denture bases fabricated by the compression molding and injection molding techniques.
4. There is no significant difference in the adaptation level of the denture bases fabricated by the compression molding and injection molding technique, using lucitone199 material.

SUBJECTS AND METHODS

Preparation of master casts

The adaptation accuracy of denture bases should be measured using specimens with the same size and shape for comparison.[1] A total of forty accurate denture bases with the same dimension were fabricated, from forty master casts. These casts were made from a silicone mold (Nissin, Kyoto, Japan) of a maxillary edentulous arch poured with a ratio of 100gm of Type III Dental stone to 30ml of water and were allowed to set for 1 hour.

Fabrication of control denture base casting.

To fabricate the initial control denture base, a dental stone master cast was duplicated using agar hydrocolloid and a refractory cast was obtained by pouring it with phosphate bonded investment material (Cobavest, Yeti). A hardening treatment was done for the refractory cast according to manufacturer's instructions. Base plate wax (Hindustan modelling wax, No 2, Hyderabad) was adapted onto the refractory cast at a thickness of 1.5-2.5mm. This was considered as an appropriate thickness for a PMMA denture base.[1,2,3,4,5] This thickness should provide adequate strength to avoid fracture of acrylic samples during removal from the investment.[6] This set-up was invested with phosphate bonded investment material (Cobavest, Yeti). Burn out procedure for the investment was done and a chrome cobalt (Wironium, Bego) casting was fabricated using induction casting machine (Fornax T, Bego). The casting was carefully removed from the investment material and it was finished and polished (Fig:1).

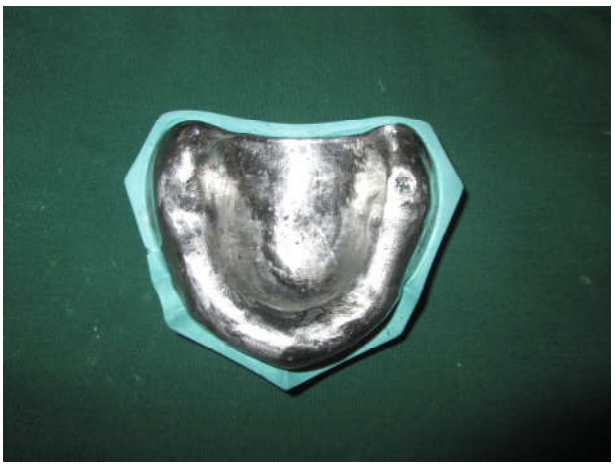
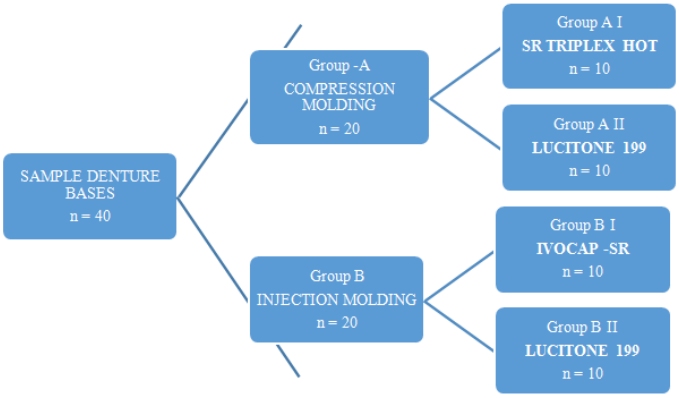


Fig 1 The standard metal denture base used in the study.

The casting was inspected for uniform thickness, adaptation on the master cast and for any casting defects. Once approved, the casting was used as a control to maintain the uniform thickness of denture base for all the samples.

For the purpose of this study, no denture teeth was included as a previous study by Henrike Venus *et al* stated that there was no significant difference in the posterior palatal gap width of dentures and toothless denture bases.[7]

Dividing the samples into groups



Investing, processing of samples.

In GROUP A, for the first 20 samples the casts along with the standard chrome-cobalt denture base were invested in the base of the dental flask No -7 with Type II dental plaster, the metal denture base was sealed to the master cast with molten modelling wax in order to prevent displacement (Fig:2).

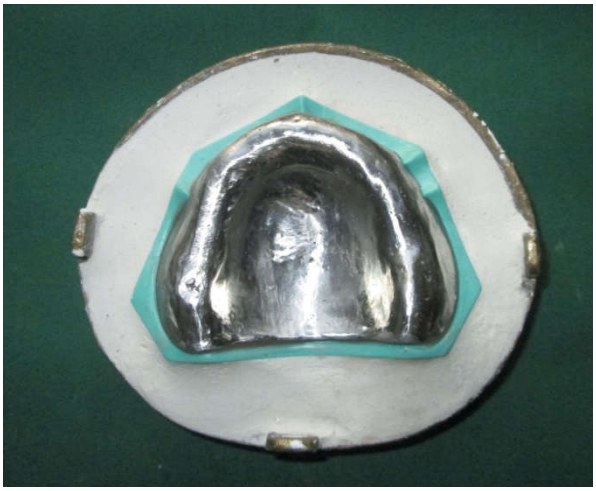


Fig 2 The standard metal denture base invested for compression molding.

Separating medium (SR Separating Fluid, Ivoclar Vivadent AG) was applied and the second pour was done with Type II dental plaster. The flask was clamped and plaster was allowed to set. Once the plaster was set the flask clamp assembly was immersed in boiling water in a dewaxing unit (Polybath, Delta) for 5 min. The flask was opened and the molten wax along with the control denture base was removed completely by keeping the flask under running hot water. A single layer of separating medium (SR Separating Fluid, Ivoclar Vivadent AG) was applied to the master cast, double thickness separating medium was applied to the mold space when the mold and cast was still warm but not hot as it may break the continuity of the separating film. All the samples were invested, packed, bench cured and processed according to manufacturer's instructions.

For the first 10 samples (A-1) heat cure polymer and monomer (SR TRIPLEX HOT POLYMER and SR TRIPLEX MONOMER-Ivoclar Vivadent) (Fig:3) was mixed with polymer monomer ratio of (23.4 gm: 10 ml) in an acrylic mixing jar (Delta).

Fig 3 Group A1 SR Triplex Hot

The acrylic dough was packed into the mold space and the flask was closed with 80 lbs pressure in a hydraulic press (Silfradent, hydraulic press 660) for 5 min. The flask was clamped and kept for bench curing for 30 min. The denture bases were processed in a acrylizing hot water bath (Polybath, delta). The closed flasks were placed in room temperature water, heated up to 100 °C and was allowed to boil for 45 min. Once polymerized, the flasks were allowed to cool down to room temperature followed by keeping under running tap water.

For the next 10 samples (A-II) heat cure polymer and monomer (LUCITONE 199 POWDER, LUCITONE 199 LIQUID – DENTSPLY) (Fig:4) was mixed with polymer monomer ratio of (21 gm: 10 ml) in a silicone mixing jar (Delta). The acrylic dough was packed into the mold space and the flask was closed with 80 lbs pressure in a hydraulic press (Silfradent hydraulic press 660) for 5 min.

Fig 4 Group A II, group B II - Lucitone 199.

The flask was clamped and was kept for bench curing for 30 min. The denture bases were processed in an acrylizing hot water bath (Poly bath, Delta) for 90 min at 73^0C followed by 30 min in boiling water. Once polymerized, the flasks were allowed to cool down in the water bath followed by keeping under running tap water.

In group B the first 10 samples (Group B-I) were injection molded using SR IVOCAP acrylic resin (Ivoclar Vivadent) (Fig:5) using SR IVOCAP heat cure injection system (Ivoclar vivadent). The investing (Fig:6), dewaxing and curing was done following the manufacturers instruction.

Fig 5 Group B I Ivocap- SR

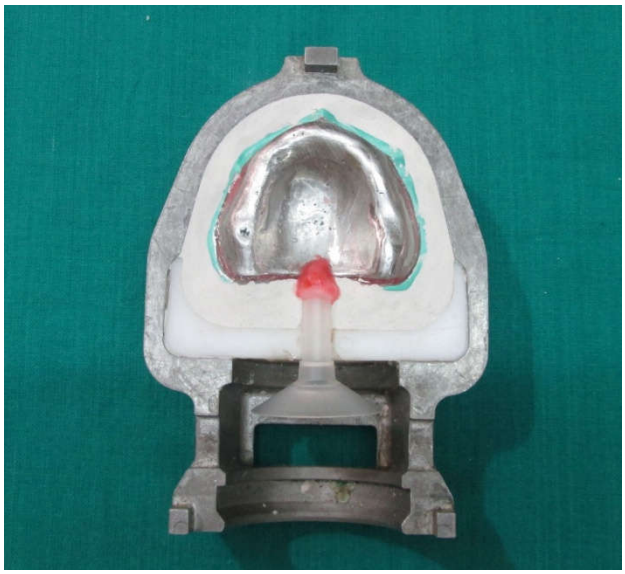


Fig 6 Investment done for the injection molding B I samples.

After dewaxing the control metal denture base was removed from the mold space. The flask halves were allowed to cool to room temperature. Separating fluid was applied twice to the moist and warm plaster surface and a single layer was applied to the cast surface.

SR Ivocap capsule which contains 20 gm polymer, 30 ml monomer was mixed according to manufacturer's instructions using a capsule vibrator for 5 min. SR Ivocap material was introduced into the mould following the manufacturers guidelines. The SR Ivocap assembly was placed in a polymerization bath (Delta) in room temperature water (Fig:7). The water was allowed to boil and the temperature was maintained for another 35 min. After completion of the 35-minute polymerization procedure, the SR Ivocap assembly was removed from the boiling water and was immediately cooled in cold water. During the first 20 minutes of the cooling phase, the pressure in the clamping frame and the injection apparatus was unchanged.

Fig 7 Polymerization of B I samples.

After 20 minutes, the pressure apparatus was removed. The clamping frame together with the flask was kept in cold water for an additional 10 minutes.

The flask was removed from the clamping frame and the divestment of flask was done according to manufacturer's instructions.

In GROUP B samples the next 10 casts (B-II) were processed with Lucitone 199 polymer and Lucitone 199 monomer, (Dentsply) using the success injection system (Dentsply). The master cast along with the metal denture base was invested in the success system flask (Fig:8).

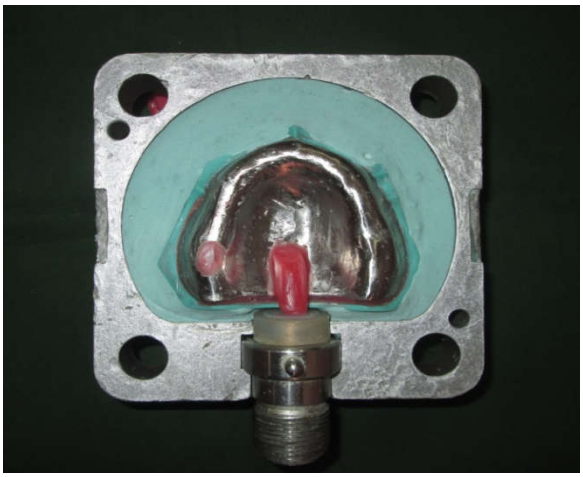


Fig 8 investing for group B II samples.

The flask was then placed in boiling water for 6 min. The flask was opened and all residual wax and the metal denture base were removed using boiling water. Separating Fluid (SR Separating Fluid, Ivoclar Vivadent) was applied to all gypsum surfaces and the flask was then allowed to cool to room temperature. The flask assembly was then attached according to manufactureres instructions for injection molding procedure.

The acrylic resin (lucitone 199 Polymer and monomer) was measured with a polymer monomer ratio of (21 gm: 10 ml) according to manufacturer's instructions in a silicone mixing jar (Delta). Once the acrylic reached dough stage, the material

was placed into the plastic injection cartridge. The flask was placed in the injection unit, and the acrylic resin was injected into the mold (Fig: 9).

Fig 9 injection molding apparatus used for group B II samples.

The flask was removed from the injection unit for bench curing. The flask was kept for bench curing for 30 min prior to curing. The closed flask was submerged in water at 73^0C for 90 min followed by an additional 30- min boil. At the end of polymerization the flask was removed from the acrylizing water bath and allowed to air cool for approximately 30 min, then the flask was placed in a lukewarm water bath to cool completely. The deflasking procedure was done once the flask reached room temperature.

Deflasking and preparation of sample for sectioning

A careful deflasking was done for all the 40 samples without causing any damage to the cast and the denture base. Immediately After deflasking each denture base was removed from their respective casts to relieve the internal stress and fixed back with epoxy cyanoacrylate glue (Fevikwik, Pidilite) to avoid base displacement during the cutting procedure.[4,8]

In all the 40 dental stone casts, cut points were selected. They were at the canine region, first molar and in the posterior palatal seal regions (Fig: 10).

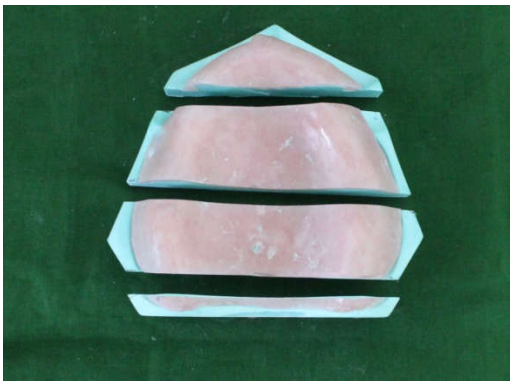


Fig 10 Cast along with denture base sectioned at three areas.

These points were selected in order to find out the overall adaptation accuracy of each sample groups. At each cut section 5 points were selected at the right and left vestibule region (VR, CR), at the right and left crest of the ridge (CR, CL), and at the midline (M).[4,5,9,10] The areas to be measured were marked in the cut section of each cast uniformly in order to allow measurement at the same locations in the denture base (Fig:11,12,13).[6]

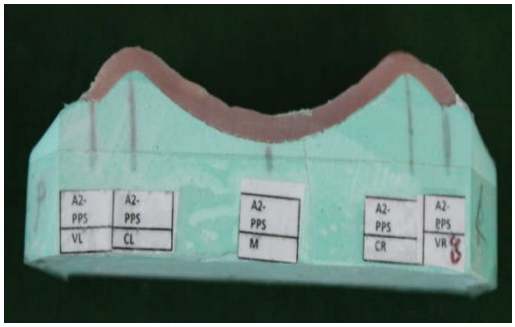


Fig 11 Posterior palatal seal (PPS) cast section showing five areas marked for measurment.

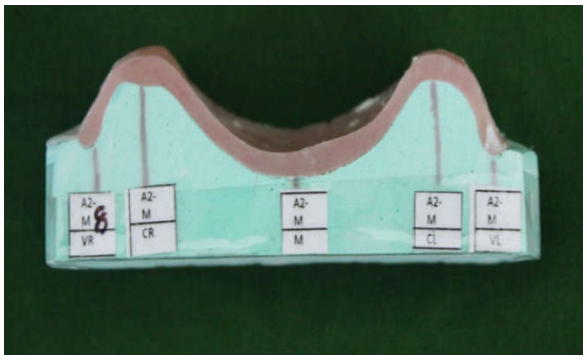


Fig 12 molar (M) cut section showing areas for measurement.

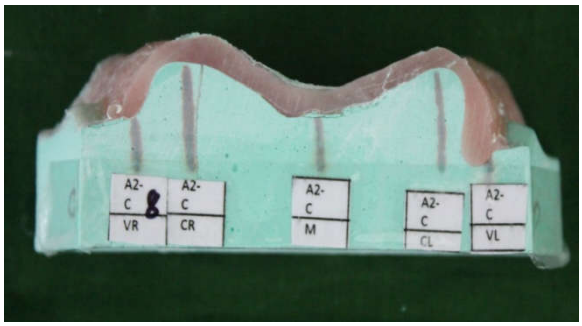


Fig 13 Canine (C) Cut section showing areas of measurement.

Sectioning of samples

All denture base-cast sets were sectioned transversely in the canine region, first molar region and posterior palatal area (5-mm away from the posterior end of the denture base) using vertical cutting machine (EM-DC2, Aixin medical equipment Co.Ltd, China) (Fig:14) with 0.35 mm Electroplated diamond disc (1575202 DFS Diamon, GmbH) with 3500 rpm under water cooling.[9,1]The casts and bases were sequentially polished with 240- to 600-grit abrasives on a lathe for refinement of the cut surfaces before microscopic inspection. A soft toothbrush with a surfactant solution and pressurized air were used to clean the interface area of debris to facilitate accurate measurement.[6] The adaptation accuracy was examined by measuring the gap formed between the master cast and the inner surface of the denture base using stereo microscope (MAGNUS MSZ-TR Magnus Analytics) with 45 X magnification at 5 pre- selected areas in each cut section.[1] The areas to be measured was marked on the cast as vertical lines using the template and the right side of the magnified line was

used in all the samples for measuring the gap using the software.

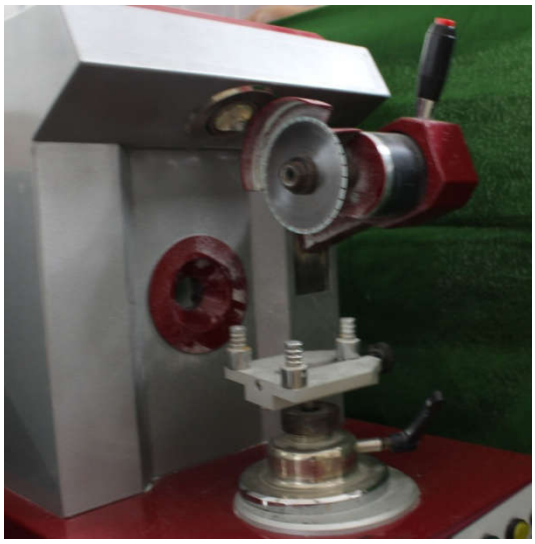


Fig 14 Vertical cutting machine used for sectioning the casts

Measuring the Gap between cast and the Denture Base

The digital images were obtained from stereo microscope using digital camera (14.1 Megapixel-DSC-W530, Sony) for 5 areas in each cut section (Fig:15).

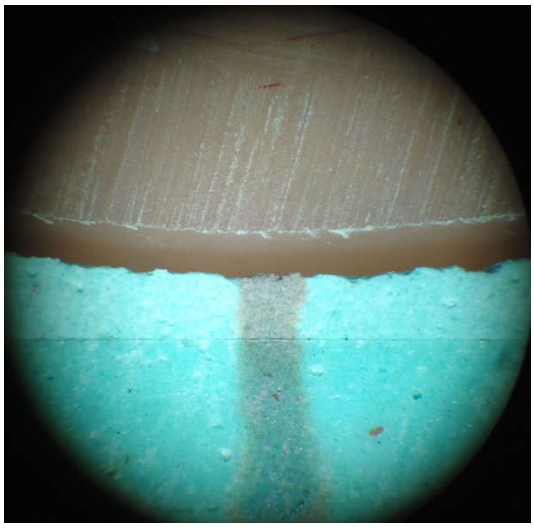


Fig 15 Image showing a sample area used for measurement.

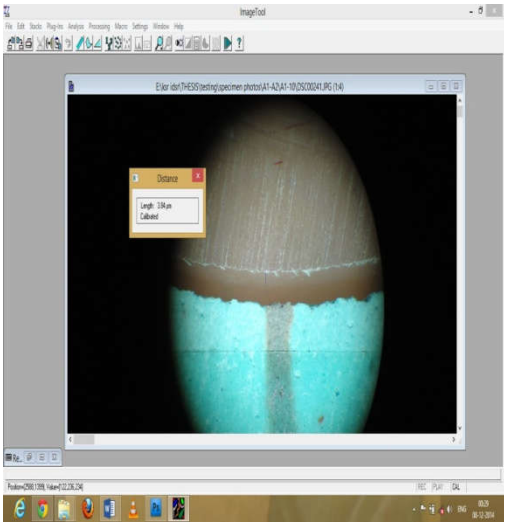


Fig 16 The software tool used for analysis.

A total of 15 images were taken from each sample. From 40 cast sets a total of 600 images were obtained. Digital images were analysed using image analysing software (CMEIAS Ver. 1.27 operating in UTHSCSA Image Tool Ver. 1.27) The gap formed between the dental stone cast and the denture base material was measured using measuring tool in micrometre scale (Fig: 16), after calibrating the software with a stage micro meter (Erma, Japan). Measurements were made three times at each of the five points on each of the three sections of each cast adding to a total of 45 measurements per cast.[9,5] The procedure was repeated on each cast in each group for a total of 1800 individual measurements on the 40 base-cast sets.

Statistical analysis

The mean overall gap measurement values, and cut section wise mean values for each sample group was subjected to statistical analysis using SPSS software package for windows (Ver. 19.0 SPSS Inc. IBM Corp). Comparison of data was made using student independent t- test with significance level of $p \leq 0.001$.

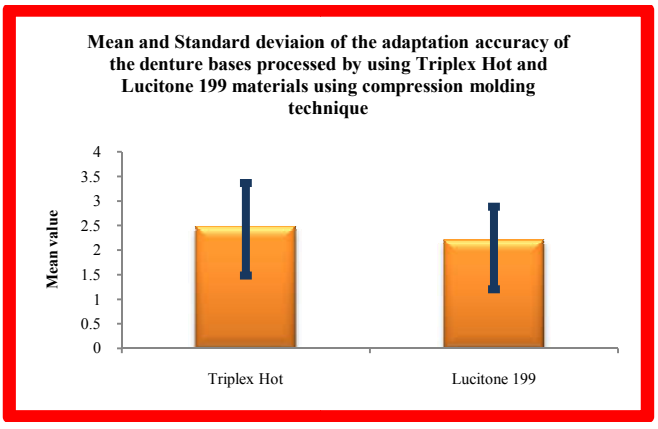
RESULTS

Table no.1 shows the descriptive statistics of the adaptation accuracy of the denture bases processed by using SR Triplex Hot and Lucitone199 materials using compression molding technique.

Table no 1 Mean and Standard deviation of the adaptation accuracy of the denture bases processed by using SR Triplex Hot and Lucitone199 materials using compression molding technique

Material	No. of dentures	Minimum (µm)	Maximum (µm)	Mean	SD	t-value	P-value
SR Triplex hot	10	1.22	3.65	2.48	0.88	0.787	0.442
Lucitone 199	10	1.28	3.91	2.20	0.68		

The mean adaptation accuracy has been 2.48 and 2.20 respectively for the material SR Triplex Hot and Lucitone 199. The two mean values have been compared using the statistical independent t-test. The non-significant p-value infers that the mean adaptation accuracy has been similar for the two materials. The results are also shown in graph no.1



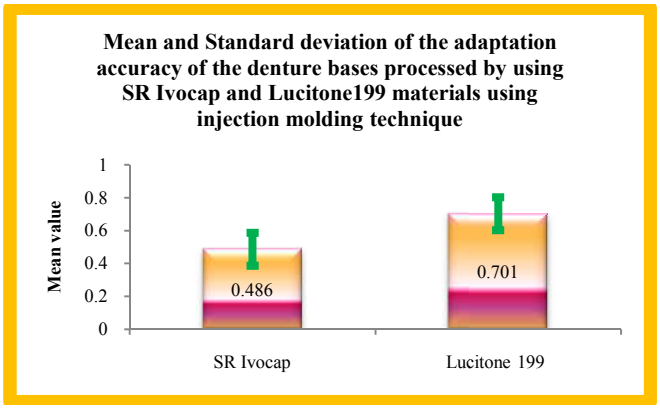
Graph no.1 Mean and Standard deviation of the adaptation accuracy of the denture bases processed by using SR Triplex Hot and Lucitone199 materials using compression molding technique

Table no.2 shows descriptive statistics of the adaptation accuracy of the denture bases processed by using SR Ivocap and Lucitone199 materials using injection molding technique.

Table no 2 Mean and Standard deviation of the adaptation accuracy of the denture bases processed by using SR Ivocap and Lucitone199 materials using injection molding technique

Material	No. of denture bases	Minimum (µm)	Maximum (µm)	Mean	SD	t-value	P-value
SR Ivocap	10	0.4220	0.5280	0.4860	0.0364	7.85	<0.001
Lucitone 199	10	0.6000	0.8250	0.7010	0.0789		

The minimum and maximum adaptation accuracy clearly indicates that Lucitone 199 material has less adaptation accuracy compared to the material SR Ivocap. The mean value of the two materials has been compared using the independent t-test. The significant p-value infers that SR Ivocap adaptation level has been higher than Lucitone 199 material using the injection molding technique. The mean and standard deviation adaptation values of the two materials are also shown in graph no.2.



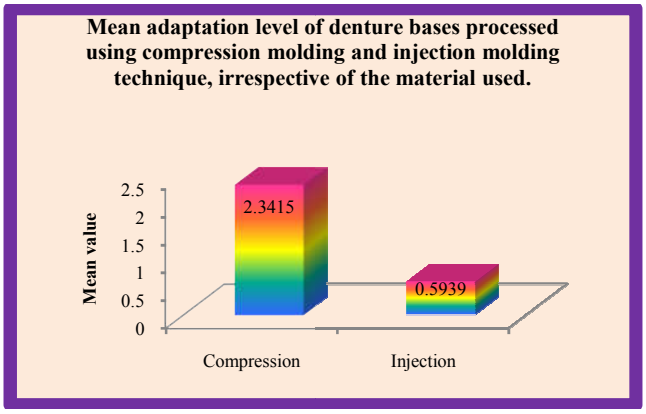
Graph no 2 Mean and Standard deviation of the adaptation accuracy of the denture bases processed by using SR Ivocap and Lucitone199 materials using injection molding technique

Table no.3 shows the descriptive statistics of the adaptation accuracy of denture bases processed using the compression molding and injection molding technique, irrespective of the material used.

Table no 3 Mean and Standard deviation of the adaptation accuracy of denture bases processed using compression molding and injection molding technique

Technique	No. of dentures	Minimum (µm)	Maximum (µm)	Mean	SD	t-value	P-value
Compression molding	20	1.22	3.91	2.3415	0.7849	9.831	<0.001
Injection molding	20	0.42	0.82	0.5939	0.1258		

The purpose of this table is to compare the two processing techniques. The minimum and maximum adaptation level of the two techniques clearly indicates that injection molding has higher adaptation accuracy compared to the compression molding irrespective of the material used. The significant p-value of the two mean value comparison infers that injection molding is superior compared to compression molding irrespective of the material used in the two processes. Graph no.3 shows the mean adaptation level of the two techniques irrespective of the material used.



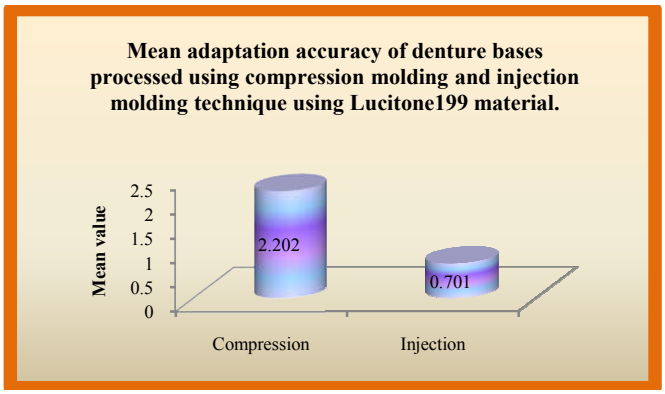
Graph No 3 Mean adaptation level of denture bases processed using compression molding and injection molding technique, irrespective of the material used

Table no.4 shows the descriptive statistics of the adaptation accuracy of denture bases processed using compression molding and injection molding technique using Lucitone199 material.

Table no 4 Mean and Standard deviation of the adaptation accuracy of denture bases processed using compression molding and injection molding technique using Lucitone199 material

Technique	No. of dentures	Minimum (µm)	Maximum (µm)	Mean	SD	t-value	P-value
Compression	10	1.28	3.91	2.202	0.6831	6.89	<0.001
Injection	10	0.60	0.82	0.701	0.0789		

The purpose of this table is to nullify the material effect in the two different molding techniques. Since the same material (Lucitone 199) was processed by using two different techniques, the mean values of moldings processed under both the techniques were compared. The significant p-value infers that injection molding is superior compared to compression molding with respect to the denture adaptation accuracy level. The mean adaptation accuracy of the two techniques using the Lucitone 199 material is also shown in graph no.4.



Graph No.4 Mean adaptation accuracy of denture bases processed using compression molding and injection molding technique using Lucitone199 material

DISCUSSION

The material for the study was selected based on availability and popularity among dentists. Since the same manufacturer had both compression molding and injection molding system it was decided to compare the Ivoclar and Dentsply material. Since Lucitone 199 heat cure acrylic resin can be processed by

both compression and injection molding, it was selected for the study.

The investing, polymer monomer ratio, mixing, packing, curing and divesting for all the samples were done strictly following the manufactures instructions. The separating medium used for all the samples were SR separating fluid (Ivoclar Vivadent). Since Dentsply does not currently market their own separating agent and since they have advocated the use of any standard separating agent or petrolatum, SR separating fluid was used for the Lucitone 199 samples also.

The denture base was removed from the cast prior to the sectioning and was replaced onto the cast in order to allow the internal stress to get relieved, as it was stated by Consani *et al*, the greatest change occurs on removal of denture from the model.[5] Anthony *et al* has concluded that the internal stress which gets relieved while separating the denture base from the cast induces significant distortion.[11]

The stress created by thermal contraction is released shortly after the denture has been removed from the mould and that stress produced by polymerization contraction will be relieved more progressively. The thermal contraction stress is of instantaneous mechanical nature, whereas the stress caused by polymerization is on a molecular level involving polymer chains. Some of the internal stresses from processing are released when the denture is deflasked and polished.[12]

The vertical cutting machine's table as well as laser pointer ensured parallel cutting of all the samples, which in turn avoided any optical errors due to faulty angulated samples under microscope.

To measure the overall adaptation, the cast was sectioned in 3 areas namely the distal of the canine, the 1st molar and the posterior palatal seal area. At each cut section five points were selected at the right and left vestibule region (VR, VL), at the right and left crest of the ridge (CR, CL), and at the midline (M). This method of measuring the overall adaptation accuracy has been reported previously by many authors.[4,5,9,13]

Three measurements were taken from each selected point and the arithmetic mean of the value was taken as the gap value of that point. The mean of all the points in one single cut section was considered as the gap value of that cut section. The mean of all the cut section gap values in a sample was taken as the gap value of that sample.

Within compression molding technique the triplex hot and Lucitone 199 did not exhibit statistically significant gap value stating that the two materials when conventionally packed and cured in short curing cycle produced dentures with similar adaptation. This result nullifies the material effect in compression molding.

When the injection molding systems were compared, the SR Ivocap system showed better adaptation accuracy compared to the Success system. This result may be explained by the technical advancement of one system compared to the other. Even though both are injection molding systems, the specialized flask, the polymer monomer ratio, resin mixing and the injection procedure varies between them considerably. The success system uses Lucitone 199 which is manually mixed with a polymer monomer ratio of 21 gm: 10 ml and packed into a disposable plastic cartridge for injection. The pressure in the flask is maintained after injection by piston cap and the pressing device and the flask is immersed completely into the hot water bath. There is no continuous injection of unpolymerised resin from sprue into the mold to compensate for the polymerisation shrinkage. In the SR Ivocap system the SR Ivocap material specially formulated for the injection molding is used. SR Ivocap capsule which contains 20 gm polymer and 30 ml monomer is mixed in a capsule vibrator and is injected continuously throughout the polymerization procedure. The system is connected to the compressed air supply during injection, polymerization as well as during cooling of flask. These differences may have contributed to the improvement of fit of denture bases processed by SR Ivocap system.

When the compression molding and injection molding techniques were compared to each other the injection molding technique showed better adaptation. This better result can be related to the processing technique. The mixed resin is injected into a cold mold and is held under constant pressure during the polymerization cycle, and during the cooling of the flask in running water, the pressure is released only after cooling of the flask is completed. To a greater extent, this helps to compensate for the polymerization shrinkage, since a reservoir of non-polymerized material is getting supplied through the sprue. Another reason for the dimensional change in the conventional compression molding technique, can be due to the excess flash which results from overfilling of the mold and is unavoidable, but in the injection molding systems, only the required amount of resin is injected into the mold space in a carefully controlled manner thus avoiding formation of excess flash.

The coefficient of linear expansion of the resin is much greater than that of the gypsum products in which it is formed and thus introduces internal strain. When the external temperature reaches more than 72^0C, internal stresses are formed in the structure. The formation of strain begins when the material reaches the temperature at which the resin begins to take on the physical properties of a solid i.e. the glass transition temperature. From this point to room temperature, the change is related to the resins coefficient of linear expansion. The gypsum products, which form the mold have a coefficient of linear expansion one-eighth that of acrylic resin. This difference contributes to the dimensional change and induces strain.

To nullify the material effect in two molding techniques, Lucitone 199 which was compression molded and injection molded was compared and studied. The results showed a significantly better adaptation for injection molded Lucitone 199 material. It can be concluded from the result that the technique rather than the material induced the property of better adaptation.

Anusavice *et al* stated that when methylmethacrylate is polymerized to form polymethyl methacrylate the density changes from 0.945 to 1.19 g/cm, which results in a volumetric shrinkage of 21% for pure monomer (polymerization shrinkage) during its polymerization.[9,14]

The dough used for fabrication of dentures actually contains 1/4 to 1/3 of monomer and as might be expected the volumetric shrinkage will usually range from slightly over 5% to about 7%. Based on a projected volumetric shrinkage of 7

%, an acrylic resin denture base should exhibit a linear shrinkage of 2 %.[15]

The clinical significance of the adaptation inaccuracy measured in a denture base- cast set is controversial. However newer denture materials and processing techniques are being introduced continuously because the contemporary techniques for denture fabrication are still unsatisfactory.23 The changes in dimension may be partially compensated by water absorption, by the resiliency of gingival mucosa and by the salivary film formed between the resin base and the soft tissue support [4,5,9]

A relatively better fit of the denture base may be helpful in reducing the initial adaptation period of the denture wearer.

References

1. Lechner S, Lautenschlager E. Processing changes in maxillary complete dentures. *The Journal of prosthetic dentistry1984;* 52(1):20–4.
2. Abby A, Kumar R, Shibu J, Chakravarthy R. Comparison of the linear dimensional accuracy of denture bases cured by the conventional method and by the new press technique. *Indian J Dent Res* 2011; 22:200-4.
3. Gomes M, Broilo J, Walber L, Maccari P, Shinkai R. Adaptation of complete denture bases submitted to chemical polishing. *Journal of applied oral science*: 2004; 12(4):322–5.
4. Consani R, Domitti S, Consani S. Effect of a new tension system, used in acrylic resin flasking, on the dimensional stability of denture bases. *The Journal of Prosthetic Dentistry* 2002; 88(3):285-89.
5. Consani R, Domitti S, Mesquita M, Consani S. Effect of packing types on the dimensional accuracy of denture base resin cured by the conventional cycle in relation to post-pressing times. *Brazilian dental journal*2004; 15(1):63–7.
6. Laughlin GA, Eick JD, Glaros AG, Young L, Moore DJ. A comparison of palatal adaptation in acrylic resin denture bases using conventional and anchored polymerization techniques. *Journal of Prosthodontics* 2001; 10(4):204-11.
7. Venus H, Boening K, Peroz I. The effect of processing methods and acrylic resins on the accuracy of maxillary dentures and toothless denture bases: an in vitro study. Quintessence international 2011; 42(8):669–77.
8. Xediek Rafael Leonardo consani , Saide Sarckis Domitti, Rizzatti Barbosa. Effect of commercial acrylic resins on dimensional accuracy of maxillary denture bases. *Braz dent j* 2002; 13(1): 57-60.
9. Amani Ramadan Ali Moussa, Dalia Yehia Ibrahim Zaki, Hisham Samir El Gabry, Tamer Mahmoud Ahmed. Comparative Adaptation Accuracy of Heat Cured and Injection Molded Resin Denture Base Materials. *Journal of Applied Sciences Research*. 2012; 8(8):4691-4696.
10. Jagger R, Milward P, Jagger D, Vowles R. Accuracy of adaptation of thermoformed poly(methyl methacrylate). Journal of oral rehabilitation 2003; 30(4):364–8.
11. Anthony D, Peyton F. Evaluating dimensional accuracy of denture bases with a modified comparator. *The Journal of prosthetic dentistry*. 1959; 9(4):683-692.
12. Dhanraj M, Ponkiruba Robin, Deepak Nallasamy, Padma Ariga, Anand S. Influence of polymerization shrinkage on denture base distortion- A systematic review. *Indian journal of multidisciplinary dentistry*. 2013; 3(2):687-694.
13. Teraoka F, Takahashi J. Controlled polymerization system for fabricating precise dentures. *J Prosthet Dent.* 2000 May; 83(5):514-20
14. Anusavice, Kenneth J. *et al*. Phillips' science of dental materials.11th edition, page no. 722 Elsevier Health Sciences, 2012.
15. Becker C M, Smith DE, Nicholls JI. The comparison of denture-base processing techniques. Part II. Dimensional changes due to processing. *J Prosthet Dent*. 1977 Apr; 37(4):450-9

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