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Original Research Article

Comparison of dimensional accuracy of various interocclusal recording materials: An in vitro study

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ABSTRACT

Dimensional stability of commonly used interocclusal records is a significant factor for precise articulation of patient's diagnostic and working casts in the fabrication of well fitting prosthesis with satisfactory occlusion. The aim of this study was to measure the dimensional accuracy of modeli g wax, aluwax, addition silicone and modeling wax corrected with zinc oxide eugenol. Total of 80 samples were fabricated. The dimensional accuracy of these materials was tested in three planes i.e. anteroposteriorly, mediolaterally and vertically. The dimensional accuracy in horizontal plane was measured with travelling micro cope and in vertical plane with digital vernier caliper. The values obtained were stati tically analysed y A OVA and Tukey HSD-Honestly significa t difference. olyvi ylsiloxane was observed to be the most dimensionally accurate material and modeli g wax, the least accurate material of all the materials tested.

1. Introduction

Interocclusal records are the means whereby the inter-arch relationships are transferred from the mouth to an articulator.[1] For the success of all complex restorative treatment procedures exact duplication of existing relationships between opposing maxillary and mandibular arches is very important.[2,3] The success of a restoration depends on the maintenance of occlusal harmony. Thus, while providing a restoration to a patient, the objective of the treatment is to provide teeth that are in harmony with the entire stomatognathic system. Interferences are observed in a restoration when teeth are placed that are not in harmony with the masticatory apparatus.[4] Thus, the goal of dentist is to provide a functional restoration without interferences that maintains the health and is in equilibrium with the entire stomatognathic system. This can only be possible if we create a mechanical equivalent on the articulator which simulates movements of mandible without any interference. Thus, we need to transfer the same relationship to articulator, which was present intraorally, so that functional restoration can be provided to the patient. This transfer requires the use of interocclusal records. Lateral interocclusal records are used to set condylar elements on articulator and protrusive interocclusal records are registered while protruding the mandible.[5] All these records are required to be transferred accurately and precisely to make articulator a mechanical analog of mouth. This ensures fabrication of an accurate prosthesis with minimal discrepancy, thus, avoiding symptoms like severe hyperactivity and incoordination of masticatory muscle function intraorally.[4,5]

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1.1. Statement of problem

The statement of problem is to compare the dimensional accuracy of various interocclusal recording materials both in horizontal (anteroposteriorly and mediolaterally) and vertical planes. The interocclusal recording materials used in this study were Aluwax, modeling wax, combination of modeling wax with zinc oxide eugenol paste and addition silicones (ExaBite II).

2. Materials and Methods

20 samples of each interocclusal recording material were fabricated. A total of 80 samples prepared and Grouped into 4 Groups of 20 samples each. The Groups were as follows:

Group I: Modelling Wax (DPI Modelling Wax)

Group II: Combination Of Modelling Wax And Zinc Oxide Eugenol Impression Paste(DPI Impression Paste and DPI Modelling Wax)

Group III: Aluwax (Morsa, Germany)

Group IV: Addition Silicone Bite Registration Paste(Exabite II)

2.1. Materials employed

1. Pink modeling wax (DPI: Dental Products of India, Bombay).
2. Zinc Oxide Eugenol impression paste (DPI Impression Paste, Dental Products of India Ltd., Bombay).
3. Aluwax (Metallised Wax Shapes For Bite Registration, MORSA Wachswarenfabrik GmbH Nordstrabe 3 86381, Germany).
4. Addition Silicone Bite Registration material.(Exabite II NDS (Product No.132412, Lot 030611), GC Dental products corporation, Japan).
5. Petroleum jelly.
6. Die Stone Type IV (Ultrarock, Kalabhai Karson Pvt. Ltd, Mumbai.).
7. Dental Plaster Type II (Dentex).

2.2. Armamentarium

1. Verticulator
2. Full arch disposable bite registration trays (Polybite, DENTAMERICA)
3. Rubber bowl
4. Wax knife
5. Glass-slab
6. Zinc oxide eugenol mixing spatula
7. Zinc oxide eugenol mixing pad
8. Dispensing gun
9. Mixing tips
10. Plaster mixing spatula
11. Cotton

2.3. Testing equipment

1. Travelling Microscope
2. Digital Vernier Caliper

2.4. Methodology

2.4.1. Fabrication of master die

Metal die consisted of maxillary and mandibular dentulous arch metal dies which could be easily brought into intercuspal position. Conical shape elevations were present on buccal cusp of maxillary and mandibular first premolar and mesiobuccal cusp of maxillary and mandibular first molar on both the right and left sides of the arch. The dies were fabricated as such so as to simulate dentulous maxillary and mandibular arches present intraorally with standardization of measurement made by conical elevations of 2mm height on premolars and molars described above. (Figure 1)

2.4.2. Verticulator

Verticulator is a type of articulator allowing movements in the vertical plane only with marked graduations on the centimeter scale so that the amount of vertical separation can be noted. (Figure 2). It consisted of

1. A broad metal base so that it can easily rest over the floor. This metal base contains a screw at one end where the mandibular die could be easily attached. At the other end, two vertical rods are emerging from the base.
2. A broad horizontal metal plate parallel to the metal base. It is provided with two holes at one end so that it can easily fit and slide over the vertical rods. A screw is provided just prior to the other end so that maxillary die could be attached to the screw with the help of mounting plates.
3. Two vertical rods having marked graduations on the centimeter scale so that the amount of vertical separation can be noted. With the help of this graduated scale, the maxillary and mandibular dies could be kept at 2mm of vertical separation

2.5. Loading of tray

Full arch disposable bite registration trays were used. Interocclusal recording materials were properly manipulated and the loaded tray was taken over the occlusal surfaces of maxillary and mandibular dies and interocclusal registration was made at 2mm of vertical separation between the maxillary and mandibular dies.

The distance being kept at 2mm is supported by the study done by Dua et al (2007)[6] where the linear

dimensional change and compressive resistance of four commercially available elastomeric interocclusal recording media was tested. Three were addition silicones and the fourth was polyether material. Cylindrical samples of 10mm diameter of each material were prepared in three different thicknesses of 2,4 and 6mm. It was observed that the samples of thickness 2mm for all the materials underwent least compression. Minimum thickness of the recording materials should be used for recording maxillomandibular relations without sacrificing the strength of the interocclusal record.[6]

2.6. Manipulation of materials

Four different interocclusal recording materials were used for the study and divided into four different Groups. Each Group consisted of 20 samples each and total of 80 samples were used for the study. The manipulation of each Group discussed below:

2.6.1. Group I: Modelling Wax (DPI Modelling Wax)

Modelling wax was molded into horse-shoe shape and loaded into the tray according to the size of the tray. The wax was placed over both the surfaces of the mesh. The loaded tray was then tempered in the water bath at 42°C ±1°C with the help of thermometer for 5 min till the wax sheets got uniformly softened. The tempered loaded tray was then placed between maxillary and mandibular metal dies at 2mm of vertical separation for 5-8min till the wax got uniformly hardened. After it, the loaded tray was carefully removed.

2.6.2. Group II: Combination of wax and zinc oxide eugenol impression paste (DPI impression paste and DPI modelling wax)

Modelling wax was molded, tempered and loaded in the same way as in the Group I and record was made. After removal of record, petroleum jelly was applied over the metal die for the easy removal of zinc oxide eugenol impression paste record. Zinc oxide eugenol impression paste was now mixed properly according to manufacturer's instructions and then applied over the surfaces of wax. Tray was then again reseated over the occlusal surfaces of maxillary and mandibular die till the material sets and then removed carefully.

2.6.3. Group III: Aluwax (Morsa, Germany)

The aluwax (already in horse-shoe shape as provided by manufacturer) was loaded into the tray and then, this loaded tray was tempered in water bath at 42°C±1°C for 5min till the wax got uniformly softened. This loaded and tempered tray was then placed between the upper and lower member of the apparatus kept at 2mm of vertical separation for 5-8min till it got uniformly hardened. It could now be removed carefully.

2.6.4. Group IV: Addition silicone (Exabite II)

This addition silicone was provided in catridge system and the material was dispensed through automixing dispenser as provided by the manufacturer over the bite registration tray. This loaded tray was then kept over the occlusal surfaces of the maxillary and mandibular dies at 2mm vertical separation till the material gets uniformly hardened. The tray was then carefully removed from the apparatus.

2.7. Measurement and testing

The samples were stored for 24hrs before the testing. The dimensional accuracy of interocclusal recording materials was measured in three planes i.e. anteroposteriorly, mediolaterally and vertically**.**

The anteroposterior and mediolateral dimensional change was measured with the help of travelling microscope and vertical dimensional change with digital vernier caliper**.**

2.8. Control group

The measurements made on the metal dies in different directions will be used as control Group and all the measurements taken from the samples will be compared with the measurements of this control Group.

2.9. Measurement of dimensional change in antero-posterior and mediolateral direction

The dimensional change in antero-posterior and mediolateral direction were measured as follows:

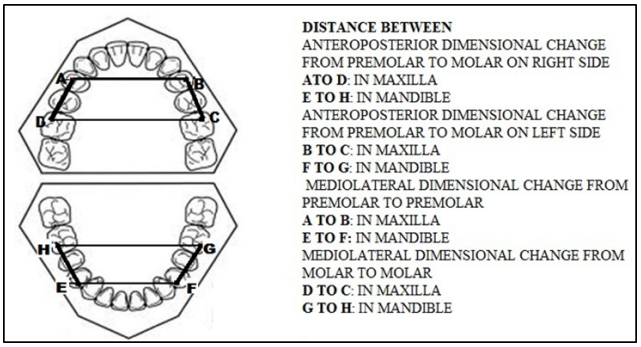

Fig. 1:

2.9.1. Vertical dimensional change

The dimensional change in vertical direction was measured with the help of digital vernier caliper by calculating the distance between the conical point tips at 2mm of vertical separation. Now, the interocclusal record was poured with die stone on both the sides of the bite registration tray. This record poured was rearticulated Now at that specified vertical separation, the distance between the elevations on the maxillary and mandibular mesiobuccal cusp of first molar and buccal cusp of first premolar on both right and left sides was measured with digital Vernier caliper.

These measurements obtained were used as control Group and all the readings of the samples were then compared with this control Group to know the amount of dimensional change occurred with the materials.

2.10. Samples (Group I, II, III, IV)

After taking the record of the maxillary and mandibular metal dies, depressions were obtained in the record as the negative replica of cone shaped elevations on the metal dies.

3. Observation and Results

Each sample size was evaluated for the dimensional accuracy in antero-posterior and mediolateral dimensional change with travelling microscope (with accuracy of± 0.001mm) and vertical dimensional change with digital Vernier caliper (with accuracy of ±0.01mm).

The mean, range, standard deviation and standard error were measured by one way ANOVA test.

Post Hoc test and Tukey Homogeneous Subset Division Test were used for statistical analysis to know that which Groups were significant and insignificant. A p-value of less than 0.005 was considered as significant.

Table 1 represents the comparison of dimensional accuracy in antero-posterior dimension of each Group with rest of the four Groups.

1. The mean antero-posterior dimensional change of Group I(2.55±0.03mm) is more than Group II, Group III AND Group IV in maxilla and mandible on both right and left sides.
2. The mean antero-posterior dimensional change of Group IV(0.29±0.04mm) less than Group I, Group II and Group III in maxilla and mandible on both right and left sides. It is statistically significant.

Table 2 represents the comparison of dimensional accuracy in mediolateral dimension of each Group with rest of the four Groups and depicts the significance and insignificance relation in between the Groups.

1. The mean mediolateral dimensional change of Group I (2.55±0.03mm) is more than Group II, Group III and Group IV in maxilla and mandible on both right and left sides. It is statistically significant.
2. The mean mediolateral dimensional change of Group IV (0.29±0.03mm)is less than Group I, Group II and Group III in maxilla and mandible on both right and left sides. It is statistically significant.

Table 3 represents the comparison of dimensional accuracy in vertical dimension of each Group with rest of the four Groups and depicts the significance and insignificance relation in between the Groups.

1. The mean vertical dimensional change of group II(0.38±0.01mm) is more than Group I, Group III and Group IV in maxilla and mandible on both right and left sides. It is statistically significant.
2. The mean vertical dimensional change of Group IV(0.08±0.01mm) less than Group I, Group II and Group III in maxilla and mandible on both right and left sides. It is statistically significant.

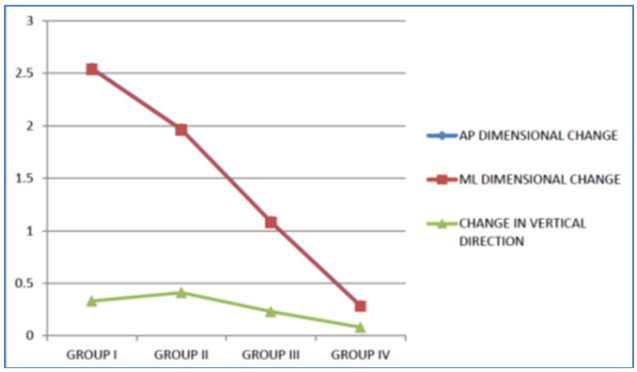

Fig. 2: Graph showing mean dimensional change in antero-posterior, medio-lateral and vertical direction

4. Discussion

The interocclusal relationship of mounted dental casts is an accurate representation of the opposing dental arches. The various methods advocated for recording interocclusal relationships are graphic, functional, cephalometric and direct interocclusal recordings.[6] The present in vitro study was conducted to measure the dimensional accuracy of various interocclusal recording materials using direct method of measuring the dimensional accuracy. In the direct method, reference points are placed on measuring cast and actual movements can be registered directly[7–10] Vergos et al[8] and Ghazal et al[9] also used direct technique for measuring the dimension accuracy of various interocclusal recording materials as used most commonly in clinical practice.

Various materials have been used for making interocclusal records like wax, zinc oxide–eugenol

Table 1: Comparisonof dimensional change in antero-posterior direction of each group with rest ofthe four groups. Post Hoc Tests

	Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
LLA	Anterioposterior (Right)	Group I	Group II	.57960(*)	.01286	<.001**
			Group IV	2.26310(*)	.01286	<.001**
			Group III	1.45935(*)	.01286	<.001**
		Group II	Group I	-.57960(*)	.01286	<.001**
			Group IV	1.68350(*)	.01286	<.001**
			Group III	.87975(*)	.01286	<.001**
		Group IV	Group I	-2.26310(*)	.01286	<.001**
			Group II	-1.68350(*)	.01286	<.001**
			Group III	-.80375(*)	.01286	<.001**
		Group III	Group I	-1.45935(*)	.01286	<.001**
			Group II	-.87975(*)	.01286	<.001**
			Group IV	.80375(*)	.01286	<.001**
	Anterioposterior (Left)	Group I	Group II	.57715(*)	.01388	<.001**
			Group IV	2.26690(*)	.01388	<.001**
			Group III	1.46255(*)	.01388	<.001**
		Group II	Group I	-.57715(*)	.01388	<.001**
			Group IV	1.68975(*)	.01388	<.001**
			Group III	.88540(*)	.01388	<.001**
		Group IV	Group I	-2.26690(*)	.01388	<.001**
			Group II	-1.68975(*)	.01388	<.001**
			Group III	-.80435(*)	.01388	<.001**
		Group III	Group I	-1.46255(*)	.01388	<.001**
			Group II	-.88540(*)	.01388	<.001**
			Group IV	.80435(*)	.01388	<.001**
Mandible	Anterioposterior (Right)	Group I	Group II	.56820(*)	.01466	<.001**
			Group IV	2.25260(*)	.01466	<.001**
			Group III	1.47550(*)	.01466	<.001**
		Group II	Group I	-.56820(*)	.01466	<.001**
			Group IV	1.68440(*)	.01466	<.001**
			Group III	.90730(*)	.01466	<.001**
		Group IV	Group I	-2.25260(*)	.01466	<.001**
			Group II	-1.68440(*)	.01466	<.001**
			Group III	-.77710(*)	.01466	<.001**
		Group III	Group I	1.47550(*)	.01466	<.001**
			Group II	-.90730(*)	.01466	<.001**
			Group IV	.77710(*)	.01466	<.001**
	Anterioposterior (Left)	Group I	Group II	.56605(*)	.01441	<.001**
			Group IV	2.26550(*)	.01441	<.001**
			Group III	1.45875(*)	.01441	<.001**
		Group II	Group I	-.56605(*)	.01441	<.001**
			Group IV	1.69945(*)	.01441	<.001**
			Group III	.89270(*)	.01441	<.001**
		Group IV	Group I	-2.26550(*)	.01441	<.001**
			Group II	-1.69945(*)	.01441	<.001**
			Group III	-.80675(*)	.01441	<.001**
		Group III	Group I	-1.45875(*)	.01441	<.001**
			Group II	-.89270(*)	.01441	<.001**
			Group IV	.80675(*)	.01441	<.001**

Table 2: Comparison ofmediolateral dimensional change of each group with rest of the four groups. PostHoc Tests

	Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Maxilla Mandible	Mediolateral (Premolar-premolar)	Group I	Group II	.58535(*)	.01241	<.001**
			Group IV	2.26680(*)	.01241	<.001**
			Group III	1.46990(*)	.01241	<.001**
		Group II	Group I	-.58535(*)	.01241	<.001**
			Group IV	1.68145(*)	.01241	<.001**
			Group III	.88455(*)	.01241	<.001**
		Group IV	Group I	-2.26680(*)	.01241	<.001**
			Group II	-1.68145(*)	.01241	<.001**
			Group III	-.79690(*)	.01241	<.001**
		Group III	Group I	-1.46990(*)	.01241	<.001**
			Group II	-.88455(*)	.01241	<.001**
			Group IV	.79690(*)	.01241	<.001**
	Mediolateral (Molar-molar)	Group I	Group II	.58030(*)	.01149	<.001**
			Group IV	2.25170(*)	.01149	<.001**
			Group III	1.45275(*)	.01149	<.001**
		Group II	Group I	-.58030(*)	.01149	<.001**
			Group IV	1.67140(*)	.01149	<.001**
			Group III	.87245(*)	.01149	<.001**
		Group IV	Group I	-2.25170(*)	.01149	<.001**
			Group II	-1.67140(*)	.01149	<.001**
			Group III	-.79895(*)	.01149	<.001**
		Group III	Group I	-1.45275(*)	.01149	<.001**
			Group II	-.87245(*)	.01149	<.001**
			Group IV	.79895(*)	.01149	<.001**
	Mediolateral (Premolar-premolar)	Group I	Group II	.57030(*)	.01399	<.001**
			Group IV	2.26360(*)	.01399	<.001**
			Group III	1.45665(*)	.01399	<.001**
		Group II	Group I	-.57030(*)	.01399	<.001**
			Group IV	1.69330(*)	.01399	<.001**
			Group III	.88635(*)	.01399	<.001**
		Group IV	Group I	-2.26360(*)	.01399	<.001**
			Group II	-1.69330(*)	.01399	<.001**
			Group III	-.80695(*)	.01399	<.001**
		Group III	Group I	-1.45665(*)	.01399	<.001**
			Group II	-.88635(*)	.01399	<.001**
			Group IV	.80695(*)	.01399	<.001**
	Mediolateral (Molar-molar)	Group I	Group II	.58770(*)	.01308	<.001**
			Group IV	2.25160(*)	.01308	<.001**
			Group III	1.46725(*)	.01308	<.001**
		Group II	Group I	-.58770(*)	.01308	<.001**
			Group IV	1.66390(*)	.01308	<.001**
			Group III	.87955(*)	.01308	<.001**
		Group IV	Group I	-2.25160(*)	.01308	<.001**
			Group II	-1.66390(*)	.01308	<.001**
			Group III	-.78435(*)	.01308	<.001**
		Group III	Group I	-1.46725(*)	.01308	<.001**
			Group II	-.87955(*)	.01308	<.001**
			Group IV	.78435(*)	.01308	<.001**

Table 3: Comparisonof vertical dimensional change of each Group with rest of the four Groups. PostHoc Tests

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	P-value
		Group I	.06950(*)	.00386	<.001**
	Group II	Group IV	.32500(*)	.00386	<.001**
		Group III	.18000(*)	.00386	<.001**
		Group II	-.06950(*)	.00386	<.001**
	Group I	Group IV	.25550(*)	.00386	<.001**
		Group III	.11050(*)	.00386	<.001**
Premolar right		Group II	-.32500(*)	.00386	<.001**
	Group IV	Group I	-.25550(*)	.00386	<.001**
		Group III	-.14500(*)	.00386	<.001**
		Group II	-.18000(*)	.00386	<.001**
	Group III	Group I	-.11050(*)	.00386	<.001**
		Group IV	.14500(*)	.00386	<.001**
		Group I	.07050(*)	.00362	<.001**
	Group II	Group IV	.32500(*)	.00362	<.001**
		Group III	.18050(*)	.00362	<.001**
		Group II	-.07050(*)	.00362	<.001**
	Group I	Group IV	.25450(*)	.00362	<.001**
		Group III	.11000(*)	.00362	<.001**
PREMOLAR left		Group II	-.32500(*)	.00362	<.001**
	Group IV	Group I	-.25450(*)	.00362	<.001**
		Group III	-.14450(*)	.00362	<.001**
		Group II	-.18050(*)	.00362	<.001**
	Group III	Group I	-.11000(*)	.00362	<.001**
		Group IV	.14450(*)	.00362	<.001**
		Group I	.07000(*)	.00367	<.001**
	Group II	Group IV	.32300(*)	.00367	<.001**
		Group III	.18200(*)	.00367	<.001**
		Group II	-.07000(*)	.00367	<.001**
	Group I	Group IV	.25300(*)	.00367	<.001**
		Group III	.11200(*)	.00367	<.001**
MOLAR right		Group II	-.32300(*)	.00367	<.001**
	Group IV	Group I	-.25300(*)	.00367	<.001**
		Group III	-.14100(*)	.00367	<.001**
		Group II	-.18200(*)	.00367	<.001**
	Group III	Group I	-.11200(*)	.00367	<.001**
		Group IV	.14100(*)	.00367	<.001**
		Group I	.06900(*)	.00452	<.001**
	Group II	Group IV	.32700(*)	.00452	<.001**
		Group III	.17800(*)	.00452	<.001**
		Group II	-.06900(*)	.00452	<.001**
	Group I	Group IV	.25800(*)	.00452	<.001**
		Group III	.10900(*)	.00452	<.001**
MOLAR left		Group II	-.32700(*)	.00452	<.001**
	Group IV	Group I	-.25800(*)	.00452	<.001**
		Group III	-.14900(*)	.00452	<.001**
		Group II	-.17800(*)	.00452	<.001**
	Group III	Group I	-.10900(*)	.00452	<.001**
		Group IV	.14900(*)	.00452	<.001**

paste, auto polymerizing acrylic and BisGMA resins, condensation-type silicones, polyether and vinyl polysiloxane. Ghazal et al[9] used aluminium wax, modeling wax, addition silicones and polyether, Pipko et al[10] used ten interocclusal recording material while Balthazar-hart et al[11] compared dimensional accuracy of four different interocclusal recording materials i.e. zinc oxide eugenol, eugenol free zinc oxide, silicones and polyether.

In the present study, interocclusal recording materials used were modeling wax, aluwax, combination of modeling wax corrected with zinc oxide eugenol and addition silicones.

Modelling wax is one of the most versatile and commonly used interocclusal recording material because of its ease of manipulation. But its high coefficient of thermal expansion and release of internal stresses make it a dimensionally inaccurate material.[12–14] Muller et al[15] did an experimental study on 8 different interocclusal recording materials to determine three dimensional errors in mounting of casts out of which, wax recorded maximum dimensional change. Other studies performed by Shrunik,[12] Millstein et al,[14] Michalakis et al,[13] Pipko et al[10] and Assif et al also depicted the same results which were consistant with the present study.

Zinc oxide eugenol paste offers minimal resistance with mandibular closure owing to the fluidity of paste before setting and becomes rigid after it sets finally. It has lengthy setting time, is brittle, stick to the teeth and rigid. Vital portions of the record can be lost through breakage on removal from the mouth and cannot be reused. Corrected wax improved the detailed recording and displacement of wax but caused increase in the vertical dimension.$ Assif et al monitored the accuracy and vertical discrepancy of four interocclusal recording materials during transfer of records to an articulator with an electromechanical device.While making record with corrected wax, they used double sheet of baseplate wax and later relined it with zinc oxide eugenol and concluded that most of the distortion was caused by wax record. Corrected wax improved the detailed recording and displacement of wax but caused increase in the vertical dimension.[11,16]

Fattore[16] and Muller et al[11] found corrected wax to be more dimensionally accurate than modeling wax alone. In the present study, wax corrected with zinc oxide eugenol showed less deviation from modeling wax anteroposteriorly (1.98±0.03mm), mediolaterally (1.97±0.04mm) and vertically (0.33±0.010mm). Thus, the results are consistent with the studies performed earlier.

The metallised wax wafer(Aluwax) has been found more accurate than non-metallised wax due to addition of metal particles (aluminium) to the modeling wax. Millstein et al[17] determined the dimensional accuracy of laminated and non-laminated, metalized and non-metalized wax interocclusal wafer as a function of initial heating, intraoral withdrawal, storage environment, storage time and seating force and concluded that metalized wafers were more accurate than those of non-metalized.. A wafer should be cooled adequately so that it doesn't distort on removal. However, abrupt withdrawal provides unnecessary additive effect to the baseline error that is already present.

In our study Aluwax showed less deviation than modeling wax i.e. anteroposteriorly (1.09±0.04mm) , mediolaterally (1.09±0.02mm) and vertically (0.22±0.01mm). These results are consistent with studies performed earlier by Millstein et al,[17] Erriksson et al,[7] Vergos et al[8] and Michalakis et al.[13]

Addition silicones are the most dimensionally stable materials attributed to the fact that it sets by addition polymerization. Also, they are easy to manipulate and offer little resistance to closure, set to a consistency that makes them easy to trim without distortion, and accurately reproduce tooth details. However, spring action found in these materials may cause inaccuracies during mounting of the casts.[18] Karthikeyan et al in 2004[19] compared the dimensional stability of three different interocclusal recording materials i.e. addition silicones, aluwax and zinc oxide eugenol at the time intervals of 1h, 24h, 48h and 72h. The addition silicones presented the minimal linear dimensional change (0.226±0.11 mm) of all the materials tested at all the time intervals followed by zinc oxide eugenol(0.443±0.064) and aluwax (0.582±0.082).

Vergos et al in 2003[8] found elastomers to be the most dimensionally stable interocclusal recording material with addition silicones and polyether showing the minimal discrepancy of 101μm and 107μm respectively. However, wax displayed the greatest discrepancy of 168μm. acrylic resin was in between wax and elastomers.

Dua et al (2007)[6] compared the linear dimensional change and compressive resistance of four commercially available elastomeric interocclusal recording media. Three were different addition silicones and the fourth was polyether material and found addition silicones to be dimensionally much more accurate than other interocclusal recording materials.

Further studies performed by Millstein et al,[13] Balthazar-Hart et al[11] and Ghazal et al[9]compared the various interocclusal recording materials with addition silicones and found addition silicones to be dimensionally much accurate than other interocclusal recording materials

The results in the study depicted that in anteroposterior and mediolateral dimension addition silicon was dimensionally most stable followed by aluwax, corrected modeling wax and modeling wax was dimensionally least stable.

In vertical plane, addition silicon was dimensionally most stable followed by aluwax,modeling wax and corrected wax was dimensionally least stable

The least dimensional accuracy of corrected modeling wax in vertical direction is attributed to the fact that though zinc oxide eugenol improved the detail of wax recording but caused increase in vertical dimension.

These results are consistent with the studies performed earlier by Dua et al in 2007,[6] Karthikeyan et al in 2004,[19] Michalakis et al in 2004,[13] Vergos et al in 2003,[8] Balthazar-Hart et al in 1981[11] and Ghazal et al in 2008.[9]

5. Conclusion

Based on the observations and results of this study, following conclusions were made:

1. Addition silicone, interocclusal recording material is most accurate in all the three planes when compared with the other three materials.
2. Aluwax is the next best material for registering interocclusal records when compared with wax and corrected wax. But it was less dimensionally accurate than addition silicon.
3. Corrected wax is the third best material for interocclusal recording. It has better dimensional accuracy when compared with modeling wax but less dimensionally accurate than addition silicone and aluwax.
4. Modeling wax is most dimensionally inaccurate material for interocclusal recording when compared with other three Groups.

Based on the results of the study, it is concluded that addition silicon as interocclusal recording material is the most accurate and modeling wax is least accurate interocclusal recording material.

It is recommended that depending on the clinical situations, different types interocclusal recording materials need to be used.

Corrective wax should be used for rechecking the record when occlusal changes are observed in the patient. Rigid materials (modeling wax, aluwax) should be used when segmental records are required and non-rigid materials (addition silicones, polyether) are found to be beneficial in accurately recording patterns of closure and avoiding mandibular deviations which is generally caused by rigid materials.

6. Conflict of Interest

None.

7. Source of Funding

None.

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