

Original Research

Resistance To Compression Of The Best Interocclusal Media And Conventionally Available Bite Registration Material In Clinical Practice In Most Of The Asian Countries – An In vitro Study

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ABSTRACT

Introduction -The fabrication of dental prosthesis requires the transfer of interocclusal records from patient's mouth to semi- adjustable articulators using different kinds of recording media. Any inaccuracy in these interocclusal records leads to occlusal errors in the final prosthesis. The fabrication of an immaculate prosthesis requires that the articulator should simulate the patient's mandibular movements as closely as possible. These articulators require interocclusal records for mounting casts and programming articulators.

Method - In this in vitro study, the linear dimensional change and compressive resistance of four commercially available elastomeric interocclusal recording media was tested. In this study , A aluminium cylinder of internal diameter of 20 mm and 20 mm height were fabricated according to manufacturer instructions. Total 40 specimens are fabricated. Materials used were polyvinyl silicones and modelling wax. 20 specimens of each materials were fabricated. Cylindrical samples of 20mm diameter of each material were prepared. The linear dimensional changes of the samples were evaluated after 24 hours of fabrication. The compressive resistance was measured when each of these was subjected to a constant compressive load of 25 Newtons in universal testing apparatus.

Result: There was notable difference between all interocclusal bite registration materials. According to the mean value of each interocclusal bite registration material, Polyvinylsiloxane Bite Registration Material have better resistance to compression than as compared to, Modeling Wax.

Conclusion: Polyvinylsiloxane interocclusal registration material had the greatest resistance to compression as compared to modelling wax because of its low dimensional stability.

Key words: Polyvinylsiloxane, dimensional stability, interocclusal bite

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INTRODUCTION

The interocclusal registration material records the occlusal relationship between the natural and/or artificial teeth for planning the prosthesis for construction of removable and fixed partial dentures. Interocclusal records are the maxilla mandibular

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Accurate interocclusal record minimizes the need for intraoral adjustments during prosthesis insertion. They are essential in providing high-quality restoration and reducing treatment time and cost. The success of the prosthetic rehabilitation treatment depends on several aspects related to the precise mounting of casts in the articulator for full mouth situations. This article helps us in understanding the various materials and techniques for prosthetic rehabilitation.

Requirements of ideal interocclusal materials

- Limited resistance before setting to avoid displacing the teeth of mandible during closure.
- Rigid or resilient after setting.
- Minimal dimension changes after setting.
- Accurate record of the incisal and occlusal surface of teeth.
- Easy to manipulate.
- No adverse effects on the tissues involved in recording procedure.
- The interocclusal record is verifiable.

Modelling wax is the most versatile and most commonly used interocclusal recording material. The reason for this material's versatility is its easy manipulation. On heating, it softens uniformly and remains same for an adequate working time. However, it is dimensionally inaccurate interocclusal recording material as it has a high coefficient of thermal expansion and high resistance to closure. Distortion of this modelling wax is also very common due to release of internal stresses, thus, leading to inaccuracies in the record. Therefore, it has been classified as the most inaccurate material among the interocclusal records studied.

Polyvinyl siloxanes are the most dimensionally stable materials till yet. As interocclusal record materials consistently yielded the least error among the materials studied. They are easy to manipulate and offer little or no resistance to closure. The excellent dimensional stability of this material is attributed to the fact that it sets by addition polymerization reaction. This study has been undertaken to evaluate and compare the compressive resistance of two interocclusal recording materials. Such as Polyvinylsiloxane Bite Registration and modelling wax.

METHODOLOGY

In this in vitro study, the linear dimensional change and compressive resistance of four commercially available elastomeric interocclusal recording media was tested. In this study, A stainless steel cylinder of internal diameter of 20 mm and 20 mm height were fabricated according to manufacturer instructions. Total 40 specimens are fabricated. Materials used were polyvinyl silicones and modelling wax. 20 specimens of each materials were fabricated. Cylindrical samples of 20mm diameter of each material were prepared. The linear dimensional changes of the samples were evaluated after 24 hours of fabrication. The compressive resistance was measured when each of these was subjected to a constant compressive load of 25 Newtons in universal testing apparatus.



STAINLESS STEEL MOULD CYLINDER

Group I: Polyvinylsiloxane Bite Registration CrèmeTM (ExabiteTM II NDS, GC America Inc.) was used.

Group II: Modeling wax (Pyrex Polykem, Roorkee, India.) was used.



Modelling wax



Polyvinyl Siloxane Bite Registration Material

Manipulation of materials

All the materials were manipulated according to manufacturer’s instructions:

Waxes were softened in a hot water bath for 5 min and placed into the mold with the help of the glass syringe.

Polyvinylsiloxane (GC) was injected into the mold by dispensing gun according to manufacturer instruction. All materials were stored in the media before manipulations to maintain its dimensional stability. All materials are mixed according to manufacturer instructions. Testing of the resistance to compression after setting of materials was performed following a modification of the method described under A.D.A. specification No. 19 for the elastomeric impression materials. One cylindrical stainless steel mold with an internal diameter of 20 mm and a height of 20 mm was constructed. after that The walls of the metallic cylinders (stainless steel mold) walls were lubricated with petroleum jelly or vaselline or separating media.



Specimens of modelling wax

for the specimens of polyvinyl siloxane materials are manipulated according to the manufacturer’s instructions. Material is loaded in the gun and material is placed under the stainless steel mould in flowable consistency. With the help of two glass slabs mould is hold, and excess material is wiped off. For the specimens of modelling wax , wax is melted and that melted wax is placed under the stainless steel mould and compressed it to reove the excess material. After setting of material specimens are removed very carefully from the mould without any distortion.... After preparing all the specimens, specimens should b placed under universal testing apparatus at constant crosshead speed and constant force. Computerised Data should be recorded by the machine itself.



Specimens of polyvinyl siloxane



Testing of the specimens: The Universal Testing Machine was used to apply the compressive force of 20 N for all the specimen.

RESULT

Descriptive data included mean, standard deviation, coefficient of variation, and range values were calculated for each of the groups. Comparisons between the groups and within the groups were done by applying one-way ANOVA followed by Tukey’s HSD test. *P* < 0.05 was considered for statistical significance.

Group I : Polyvinyl Siloxane Bite Registration Material (Exabite™ II NDS, GC America Inc.) Specimens with internal diameter 20mm and height 20mm		
100g/cm²	1000g/cm²	Difference
A	B	A – B
0.0197	0.0246	0.0049
0.0197	0.0248	0.0051
0.0207	0.0251	0.0044
0.0206	0.0261	0.0055
0.0214	0.0256	0.0042
0.0196	0.0244	0.0048
0.0197	0.0248	0.0051
0.0209	0.0251	0.0042

0.0206	0.0261	0.0055
0.0219	0.0256	0.0037
0.0197	0.0248	0.0051
0.0207	0.0251	0.0044
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0.0219	0.0256	0.0037
0.0196	0.0244	0.0048
0.0197	0.0248	0.0051

Group II : Modeling wax (Pyrex Polykem, Roorkee, India.)		
Specimens with internal diameter 20mm and height 20mm		
100g/cm²	1000g/cm²	Difference
A	B	A – B
0.0274	0.0374	0.01
0.0275	0.038	0.0105
0.0267	0.0371	0.0104
0.0274	0.0365	0.0091
0.028	0.0374	0.0094
0.0274	0.0374	0.01
0.0275	0.04	0.0125
0.0267	0.0378	0.0111
0.0274	0.0365	0.0091
0.028	0.0379	0.0099
0.0275	0.038	0.0105
0.0267	0.0371	0.0104
0.0274	0.0365	0.0091
0.028	0.0374	0.0094
0.0274	0.0374	0.01
0.0267	0.0378	0.0111
0.0274	0.0365	0.0091
0.028	0.0379	0.0099
0.0274	0.0374	0.01
0.0267	0.0378	0.0111
0.0274	0.0365	0.0091
0.028	0.0379	0.0099
0.0274	0.0374	0.01
0.0275	0.04	0.0125

Among the specimens, Polyvinylsiloxane bite registration material showed the compression distance value (0.019mm min. - 0.026mm max., mean at 100g/cm² = 0.020 and mean at 1000g/cm² = 0.025) and Modeling wax (0.026mm min. – 0.038mm max., mean at 100g/cm² = 0.027 and mean at 1000g/cm² = 0.037), Polyvinyl siloxane material has greater resistance to compression as compared to modelling wax.

DISCUSSION

This test revealed that compared to the rest of the interocclusal recording media tested, polyvinylsiloxane interocclusal registration material had the greatest resistance to compression. The importance of accurate, reliable recordings of jaw relations cannot be over emphasized. The function of indirectly made crowns and fixed partial dentures is directly related to this critical step. Proper

interocclusal records minimizes pre- insertion adjustments to the restorations and saves chair side time or repetition of some clinical and technical stages.

Polyvinylsiloxane and Polyether Bite Registration Materials are characterized by short working time, setting time, high stiffness, low-percent strain in compression, and low flow. Wax showed a decrease in compressive resistance in specimens when compared to other interocclusal recording materials. There is general agreement that waxes, in any of the numerous forms available baseplate, Beauty hard wax, metallized or metallized with an aluminum laminate are the least accurate materials. Wax registrations can be distorted upon removal, may a change dimension by release of internal stresses depending on the storage condition, have high flow properties, undergo large dimensional changes on cooling from mouth to room temperature .

Various methods of recording maxillomandibular relationships like graphic, functional, cephalometric, and direct interocclusal can be used.⁸ Direct interocclusal records are commonly used to record maxillomandibular relationships. The recording material, which is soft initially fills the spaces between teeth, hardens, and records the specific relationship of the arches.

The importance of accurate, reliable recordings of jaw relations cannot be over emphasized. The function of indirectly made crowns and fixed partial dentures is directly related to this critical step.¹¹ Proper interocclusal records minimizes pre- insertion adjustments to the restorations and saves chair side time or repetition of some clinical and technical stages. In this study, polyvinylsiloxane bite registration material showed greater resistance to compression than the other interocclusal recording materials. This observation was in correlation with the studies of Breeding and Dixon; Michalakis *et al.*, who showed that polyvinylsiloxane displayed the greatest resistance to compression as compared to conventionally used modelling wax.

CONCLUSION

Accurate interocclusal record minimizes the need for intraoral adjustments during prosthesis insertion. They are essential in providing high-quality restoration and reducing treatment time and cost. The success of the prosthetic rehabilitation treatment depends on several aspects related to the precise mounting of casts in the articulator. In the present study it is concluded that Resistance to compression of the best interocclusal media and conventionally used bite registration material in clinical practice is polyvinyl siloxane as compared to modelling wax when subjected to compressive load.

Thus the study concluded that modelling wax can be used for bite registration to reduce minimal errors in selective occlusal grinding and bite records for short

duration but for more accuracy polyvinyl siloxane bite registration material should be used for best results.

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