

A Comparative Evaluation of Compressive Resistance of Three Commercially Available Interocclusal Record Materials. - An In Vitro Study

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ABSTRACT:

Aim: To explore and check a comparative evaluation of compressive resistance of three commercially available interocclusal record materials.

Method: Three commercially available used interocclusal recording materials were selected for study-

- 1) Commercially available polyvinyl siloxane interocclusal record material.
- 2) Commercially available WAX interocclusal record material.
- 3) Commercially available polyether interocclusal record material.
- 4) Specimen of 2mm length and 10mm diameter and 5mm length and 10 mm in diameter were prepared.

The polyvinyl siloxane material were packed in cartridges by means of specific syringe tubes.

The polyether materials were packed in tubes and hand mixed according to manufacturers direction.

The wax are immersed in water bath for 1 min at 135°F/58°C, it becomes soft and ready for use.

According to ADA -19, each materials was mixed to prepare specimen of specific dimensions and allowed to harden before removal from cylinder.

30 specimen (length 2mm and 5mm and 10 mm diameter for both lengths) were fabricated of each material and tested for 1 hour and 24 hours.

Over 180 specimen were fabricated and tested and subjected to constant force of 25N by means of universal testing materials.

Representative force-extension graphs were generated for individual specimens by the Q Mat software.

The results obtained were analysed using two-way ANOVA test and one-way ANOVA test.

Results: There was a significant difference in the compression distance values of Poly vinylsiloxane (Jetbite) and Polyether (Ramitec) and Wax (Denar) interocclusal record materials at thickness of 2mm and 5mm at both time intervals of 1 hour and 24 hour time interval.

- There was a significant difference in the compression distance values of Poly vinylsiloxane (Jetbite) and Polyether (Ramitec) and Wax (Denar) interocclusal record material at thickness of 2mm at time interval of 1 hour.
- There was no significant difference seen in the compression distance values of Polyether (Ramitec) and Wax (Denar) at thickness of 2mm at interval of 24 hours. Polyvinyl siloxane (Jetbite) showed the least compression distance values amongst all 3 interocclusal record materials at thickness of 2mm and time interval of 24 hours.
- There was a significant difference in the compression distance values of Poly vinyl siloxane (Jetbite) and Polyether (Ramitec) and Wax (Denar) interocclusal record material at thickness of 5mm at time interval of 1 hour.

- There was a significant difference in the compression distance values of Poly vinyl siloxane(Jetbite) and Polyether(Ramitec) and Wax(Denar) interocclusal record material at thickness of 5mm at time interval of 24 hours.

Conclusion: Wax(Denar) exhibits least compressive distance values or greatest resistance to compression at thickness 2mm at time interval of 1 hour and 5mm thickness at time interval of both 1 hour and 24 hours.

- Polyvinyl siloxane(Jetbite) showed least compressive distance values at thickness of 2mm at time interval of 24 hours.
- Polyether (Ramitec) showed least resistance to compression or compressive distance values when compared to both Jetbite and Denar wax .

I. INTRODUCTION

“Dentistry revolves around occlusion, No occlusion No dentistry.”

Occlusion is the meeting ground of all specialties of dentistry. The study of occlusion and jaw relations with respect to functions of the masticatory system. Correct interocclusal record gives the clinician the opportunity to make minimal adjustment of the prosthesis in the oral cavity thus avoiding additional chairside time in eliminating occlusal discrepancies. Interocclusal records have become the most popular method of transfer of maxillomandibular relations from the oral cavity to the articulator. An interocclusal record is a precise recording of a maxillomandibular position with each other. Apart from the operator's clinical ability and technique followed, the material selected can critically affect the accuracy of the interocclusal registration

A compressive force is commonly exerted on the interocclusal recording material during this procedure and may cause inaccuracies during mounting of the casts and distortions during fabrication of the restorations. The ability of an interocclusal recording material to resist compressive forces is critical because of its potential to get deformed thus resulting in inaccurate records. The material may get deformed when compressed under load. Dimensional changes may also occur with storage of interocclusal records with time. Therefore, they should possess high initial hardness and be rigid to resist compressive forces and hence, not allow a yielding mounting. Due to high final hardness and high fracture toughness, it is easy to trim. Moreover, undesirable shifts are prevented when adjusting the position of the casts on articulator.

The recently introduced materials in market have promising claims about meeting the ideal requirements. Thus this study has been planned to compare and evaluate the compressive resistance of polyvinylsiloxane, poly ether and wax thus helping the clinician make an appropriate choice of interocclusal record material depending on the case.

II. MATERIAL AND METHOD

The present study was conducted to compare and evaluate the compressive resistance of three different interocclusal record materials ie Polyvinyl Siloxane, polyether and wax in two different thickness (2mm and 5mm) at different time intervals of 1 hour and 24 hours.

Product/ Material	Type	Fabrication Technique	Lot/ Serial Number	Manufacturer
JETBITE	POLYVINYL SILOXANE BITE REGISTRATION MATERIAL	AUTOMIX	REF 6400	COLTENE/WHALED ENT, USA
DENAR WAX	WAX BITE REGISTRATION MATERIAL	HAND MIX	20000040	WHIPMIX CORPORATION, USA
RAMITEC	POLYETHER BITE REGISTRATION MATERIAL	HAND MIX	33710	3M ESPE, DENTAL PRODUCTS, USA
VASELINE	PETROLEUM JELLY		BATCH NO 67	HINDUSTAN UNILEVER LTD.

III. METHODOLOGY

Methodology conformed to a sequence of steps in this in-vitro study as follows:

STEP	PROCEDURE
1	Fabrication of stainless steel die.
2	Fabrication of Specimens.
3	Measurement of compressive resistance.

The interocclusal record materials were divided into 3 groups ie

- i)GROUP 1 : Polyvinyl siloxane bite registration material(JETBITE).
- ii)GROUP 2 : Polyether bite registration material(RAMITEC).
- iii)GROUP 3 : Wax bite registration material(DENAR WAX).

The polyvinyl siloxane material were packed in cartridges by means of specific syringe tubes.

The polyether materials were packed in tubes and hand mixed according to manufacturers direction.

The wax are immersed in water bath for 1 min at 135⁰ F/58⁰ C ,it becomes soft and ready for use.

According to ADA -19,each materials was mixed to prepare specimen of specific dimensions and allowed to harden before removal from cylinder.

30 specimen (length 2mm and 5mm and 10 mm diameter for both lengths) were fabricated of each material and tested for 1 hour and 24 hours.

Over 180 specimen were fabricated and tested and subjected to constant force of 25N by means of universal testing materials.

IV. RESULTS

- There was a significant difference in the compression distance values of Poly vinylsiloxane(Jetbite) and Polyether(Ramitec) and Wax(Denar) interocclusal record materials at thickness of 2mm and 5mm at both time intervals of 1 hour and 24 hour time interval.
 - There was a significant difference in the compression distance values of Poly vinylsiloxane (Jetbite) and Polyether(Ramitec) and Wax(Denar) interocclusal record material at thickness of 2mm at time interval of 1 hour.
 - There was no significant difference seen in the compression distance values of Polyether(Ramitec) and Wax(Denar) at thickness of 2mm at interval of 24 hours. Polyvinyl siloxane(Jetbite) showed the least compression distance values amongst all 3 interocclusal record materials at thickness of 2mm and time interval of 24 hours.
 - There was a significant difference in the compression distance values of Poly vinyl siloxane(Jetbite) and Polyether(Ramitec) and Wax(Denar) interocclusal record material at thickness of 5mm at time interval of 1 hour.
 - There was a significant difference in the compression distance values of Poly vinyl siloxane(Jetbite) and Polyether(Ramitec) and Wax(Denar) interocclusal record material at thickness of 5mm at time interval of 24 hours.
 - Wax(Denar) exhibits least compressive distance values or greatest resistance to compression at thickness 2mm at time interval of 1 hour and 5mm thickness at time interval of both 1 hour and 24 hours.
 - Polyvinyl siloxane(Jetbite) showed least compressive distance values at thickness of 2mm at time interval of 24 hours.
- Polyether (Ramitec) showed least resistance to compression or compressive distance values when compared to both Jetbite and Denar wax

V. DISCUSSION

The basic objectives for occlusal rehabilitation are optimum oral health, functional efficiency, oral comfort and aesthetics. An accurate transfer of maxillomandibular relation from the patients oral cavity to the articulator is essential for the treatment of occlusal reconstructions and other treatment modalities. The facebow transfer, vertical and horizontal jaw relation records, together establish the simulation of mandibular movements on the articulator. Establishing a functional occlusion is a primary goal in restorative dentistry for all prosthodontists. A Correct interocclusal record avoids occlusal discrepancies to a great extent thereby eliminating the need for additional adjustment of the prosthesis which helps in reducing the chairside time. The causes of occlusal inaccuracies are attributed to interocclusal records that can be divided into 3 main groups:

- 1) Anatomic and physiologic characteristics of the patient. This factor is associated with
 - a) Vertical displacement of the condyle (superiorly and inferiorly).
 - b) Displacement of the teeth because of the flexibility of periodontal attachment.

- c) Flexing of the mandible during opening and closing movements.
 - d) Compression of soft tissues in the edentulous areas.
 - e) Mandibular positional variation due to muscular activity.
- 2) Dentist induced causes; these are related to variations in the procedure and the materials during clinical use
- 3) Properties of the interocclusal record material and technician manipulation during use. The ability of an interocclusal registration material to resist compressive forces is very important because any discrepancy between the intraoral relationships of the teeth and the position of the teeth on the mounted working casts will result in restorative errors Polyvinylsiloxane shows to be less time sensitive, and as a result are more appropriate for the registration of maxillomandibular relationships. Polyvinylsiloxane and polyether bite registration materials are characterized by short working time, setting time, high stiffness, low-percent strain in compression and low flow. This study indicated that errors of clinical significance were introduced in all situations tested. However, the minimal error recorded with a 2 mm and 5 mm thickness of wax (DENAR) bite registration material would result in castings with suitable occlusal contacts on the articulator and without intraoral occlusal contacts. Therefore, if these interocclusal recordings are used for mounting working casts in the fabrication of the prostheses, the casts should be secured in a record in such a manner that ensures complete seating but exerts a minimal compressive force

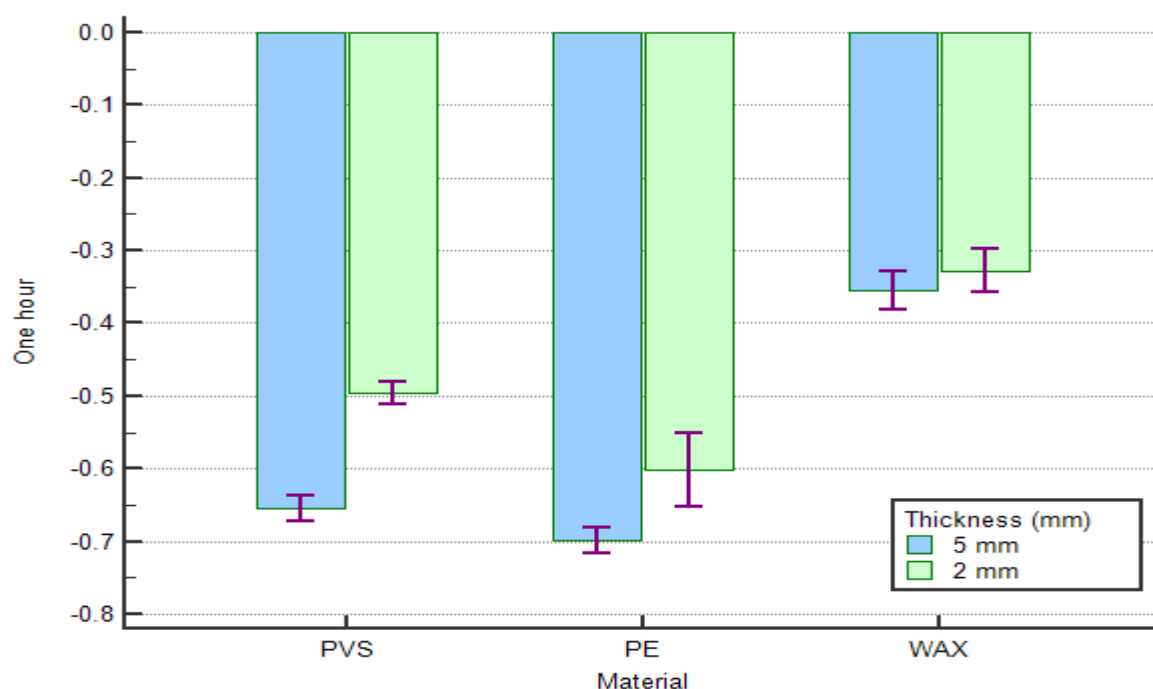
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Tables and graphs.

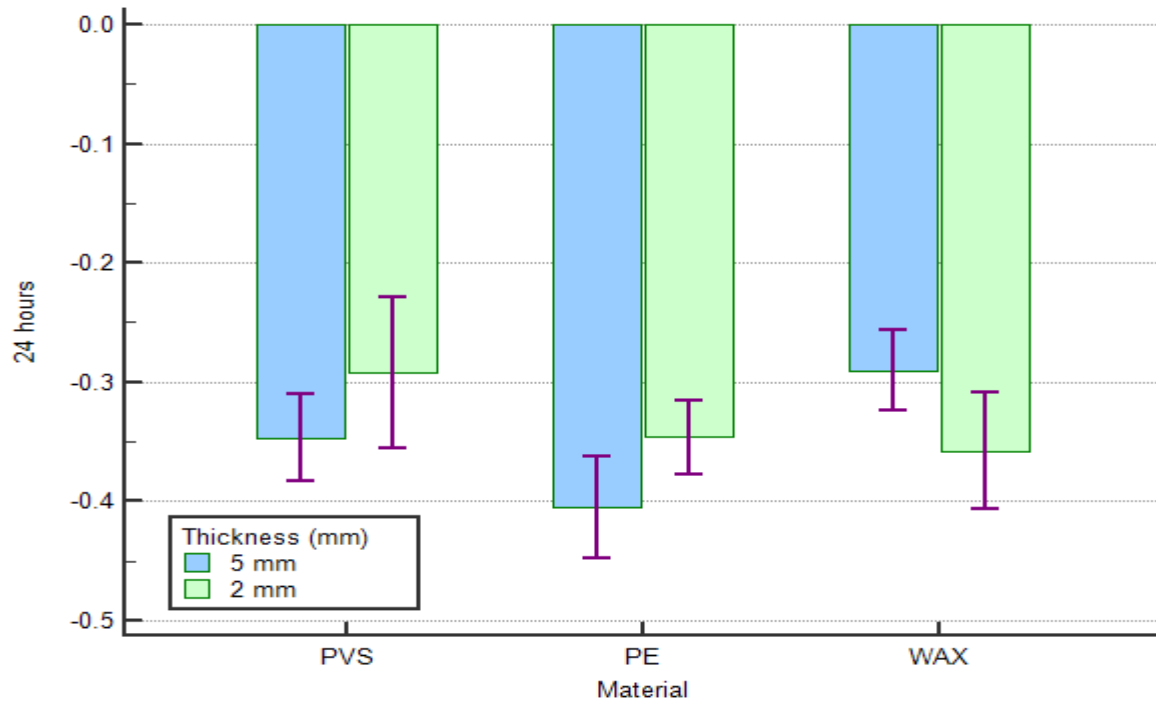
GRAPH NO 1:

Descriptive analysis of comparison of compression distance values all 3 interocclusal record materials at time interval at 1 hour showing distribution of mean, standard error and standard deviation values (Inter group).



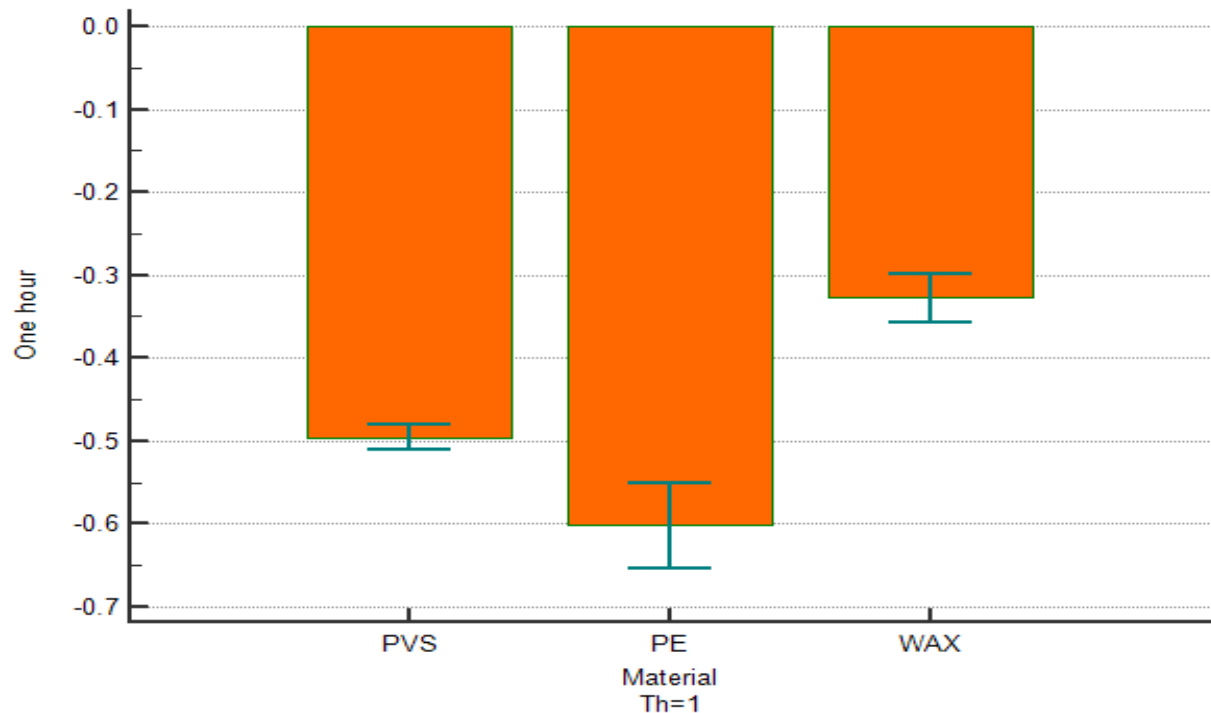
GRAPH NO 2:

Descriptive analysis of comparison of compression distance values all 3 interocclusal record materials at time interval at 24 hour showing distribution of mean, standard error and standard deviation values (Intergroup).



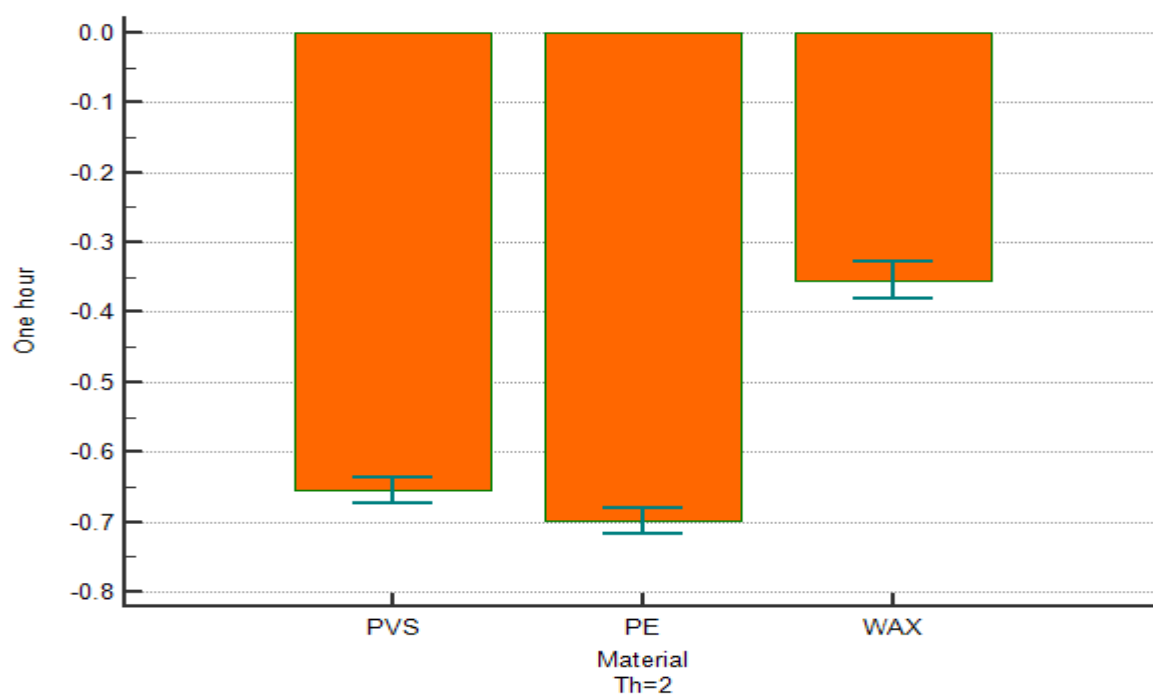
GRAPH NO 3

Intergroup comparison of compression distance values of 2mm thickness at time interval of 1 hour between all 3 groups of interocclusal record materials.



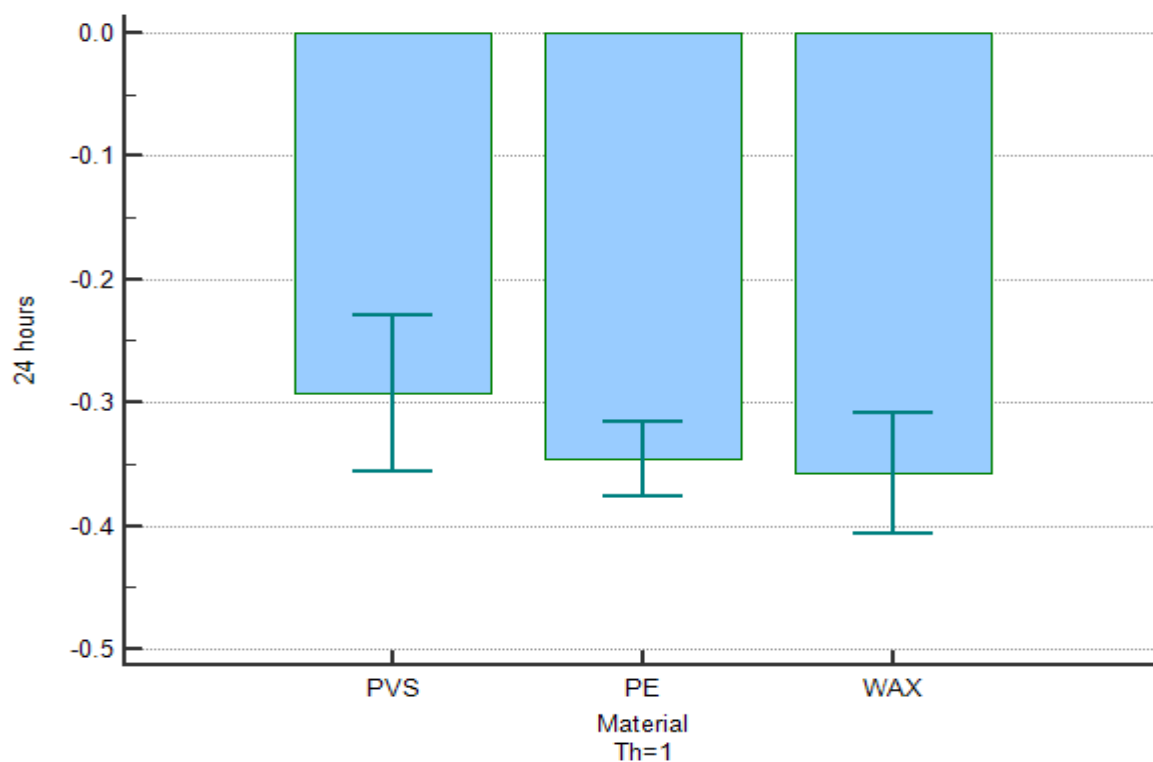
GRAPH NO 4

Intergroup comparison of compression distance values of 5mm thickness at time interval of 1 hour between all 3 groups of interocclusal record materials.



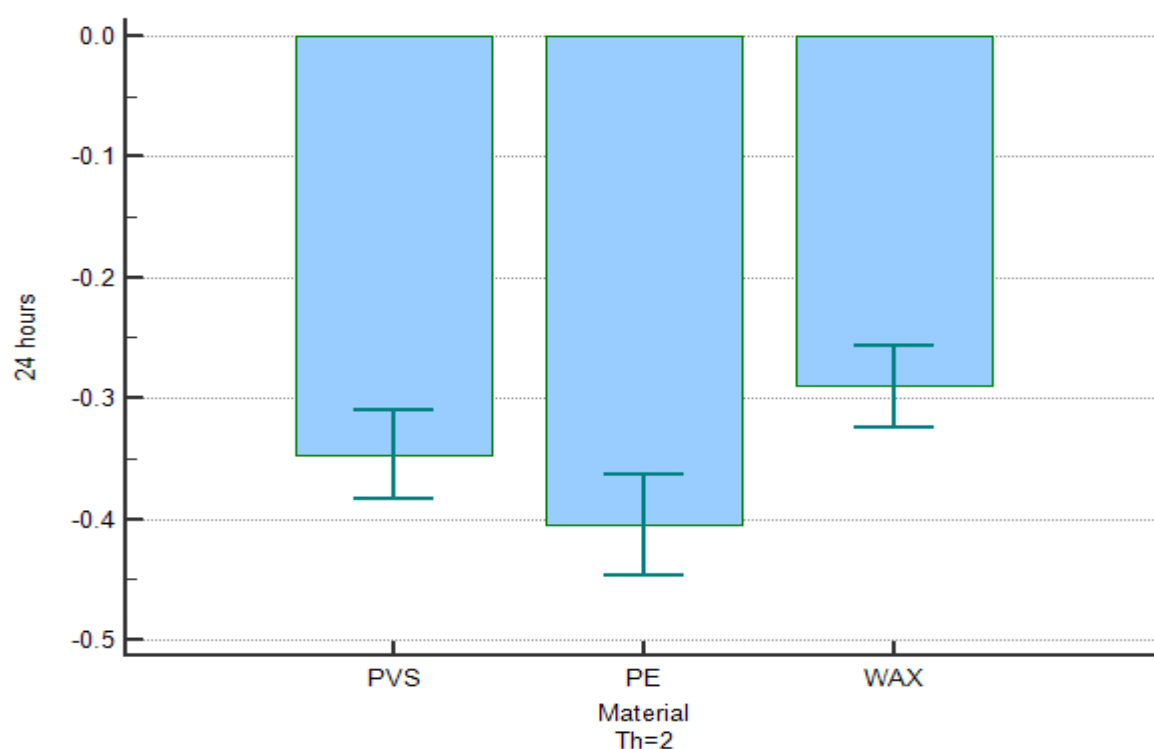
GRAPH NO 5

Intergroup comparison of compression distance values of 2mm thickness at time interval of 24 hours between all 3 groups of interocclusal record materials.



GRAPH NO 6

Intergroup comparison of compression distance values of 5mm thickness at time interval of 24 hours between all 3 groups of interocclusal record materials.



TABLES

Material	Thickness	n	Mean	Std. Error	Standard deviation	P ^a
PE	2 mm	30	-0.6019	0.01425	.1380234	<0.0001
	5 mm	30	-0.6984	0.01425	.0469764	<0.0001
PVS	2 mm	30	-0.4959	0.01425	.0412650	<0.0001
	5 mm	30	-0.6550	0.01425	.0485756	<0.0001
WAX	2 mm	30	-0.3274	0.01425	.0784797	<0.0001
	5 mm	30	-0.3545	0.01425	.0713840	<0.0001

Material	Thickness	n	Mean	Std. Error	Standard deviation	P ^a
PE	2 mm	30	-0.3460	0.02156	.0824738	<0.0001
	5 mm	30	-0.4048	0.02156	.1131202	<0.0001
PVS	2 mm	30	-0.2921	0.02156	.1692683	<0.0001
	5 mm	30	-0.3469	0.02156	.0980184	<0.0001
WAX	2 mm	30	-0.3575	0.02156	.1324849	<0.0001
	5 mm	30	-0.2901	0.02156	.0910874	<0.0001

Source of variation	Sum of Squares	DF	Mean Square
Between groups (influence factor)	1.1497	2	0.5749
Within groups (other fluctuations)	0.7805	87	0.008971
Total	1.9302	89	

F-ratio	64.081
Significance level	P < 0.001

Scheffé test for all pairwise comparisons

Factor	n	Mean	SD	Different from factor nr (P<0.05)
(1) PE	30	-0.6019	0.1380	(2)(3)
(2) PVS	30	-0.4959	0.04127	(1)(3)
(3) WAX	30	-0.3274	0.07848	(1)(2)

Factor	n	Mean	SD
(1) 1	20	1938.63	537.9
(2) 2	20	2805.20	511.94
(3) 3	20	541.8	204.42

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