Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
ISSN NO. 2320-5407
Article DOI: 10.21474/IJAR01/8574
DOI URL: http://dx.doi.org/10.21474/IJAR01/8574

RESEARCH ARTICLE

EFFECT OF IMMERSION AND SPRAY ATOMIZATION TECHNIQUE OF DISINFECTION ON COMPRESSION RESISTANCE OF TWO INTEROCCLUSAL RECORDING MATERIALS.

Junu Henry[1], Basavaraj S. Salagundi[2], Rupesh P. L[3], Bhavana B.L[4], Bharat Kataraki[4] and Vachan Poonacha[5].

1. MDS III[rd year] Postgraduate, Coorg Institute of Dental Sciences, Karnataka, India.
2. MDS, Professor and Head Of Department, Coorg Institute of Dental Sciences, Karnataka, India.
3. MDS,Professor and Chair, Coorg Institute of Dental Sciences, Karnataka, India.
4. MDS, Senior Lecturer, Coorg Institute of Dental Sciences, Karnataka, India.
5. MDS, Reader, Coorg Institute of Dental Sciences, Karnataka, India.

Manuscript Info

Manuscript History
Received: 14 December 2018
Final Accepted: 16 January 2019
Published: February 2019

Key words:-
Polyvinyl siloxane interocclusal recording material; polyether interocclusal recording material; compression resistance; tear strength; sodium hypochlorite solution.

Abstract

This in-vitro study investigated the effect of immersion and spray atomization technique of disinfection using 0.5% of sodium hypochlorite solution on compression resistance of polyvinyl siloxane and polyether interocclusal recording materials. This study comprised of a total of 60 samples, wherein 30 samples each of polyvinyl siloxane and polyether underwent compression resistance. These 30 samples of each were again divided into 3 subgroups comprising of 10 specimens each - a control group, a group subjected to spray atomization disinfection technique for 10 mins and a group subjected to immersion technique for 10 mins following which they were subjected to compression resistance in a universal testing machine. One-way ANOVA and Post-Hoc Tukeys test were used for statistical analysis. Results showed that Polyvinylsiloxane interocclusal recording material showed better resistance to compression than polyether interocclusal recording material and Immersion technique of disinfection was better for polyvinylsiloxane and spray atomization technique of disinfection for polyether. Hence it could be concluded that Polyvinylsiloxane material can be used as an interocclusal recording material because of its greater resistance to compression and can be subjected to immersion technique of disinfection.

Introduction:-

An interocclusal record is a precise recording of a maxillomandibular position.[1]The forces exerted on these records during removal from mouth or articulation depends on the thickness, properties of the material, the storage, the time interval between making the records, and articulation time affects these changes. Hence, the selection of interocclusal recording material is critical, depending on the situation.[1] Interocclusal recording materials are partly responsible for accurate precision and occlusal quality of final prosthetic restorations when used for mounting casts on the articulators. Accurate mountings can lead to restorations that require minimal occlusal

Corresponding Author:-Junu Henry.
Address:-MDS III[rd year] Postgraduate, Coorg Institute of Dental Sciences, Karnataka, India.

modifications intraorally, thus reducing the chairside time.[2] Apart from the operator's clinical ability and the technique followed the material used can critically affect the accuracy of interocclusal registration.[2]

Polyvinylsiloxane elastomeric materials are recently been introduced.[1] Addition silicone impression materials (polyvinylsiloxane) have been widely accepted due to excellent dimensional stability, superior recovery from deformation, and precise detail reproduction.[3]

Recording and transferring of accurate existing occlusal records is of prime importance for a successful restoration. Interocclusal recording of the relationship of the mandible to the maxilla is a simple but complex procedure. The inaccuracies attributed to the interocclusal records can be divided into three main categories:
1. The biologic characteristics of stomatognathic system,
2. Manipulation of the material and
3. The properties of the interocclusal recording materials

Polyvinyl siloxane have also shown to have better resistance to compression.[3] One of the most desirable characteristics of the interocclusal registration material is resistance to compression after polymerization. The material should be rigid enough to resist the distortion that might be caused from the weight of the dental casts, the components of the articulator, or other means used to stabilize the casts during the mounting procedure. 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.[2] It has been shown that the compression resistance decreases as the thickness increases.[4]

Interocclusal registration materials act as a significant source of cross contamination, so these must be disinfected immediately after their removal from mouth. Occupational safety and health association (OSHA) guidelines in 1996 required dentist, dental laboratory employers and other employers in health care fields to provide protection for their employees against the possibility of infection transmission by implementation of conscientious and consistent barrier controls.[8] There are two important factors to consider when choosing a disinfectant namely, its ability to eliminate microbial contamination and its effect on the resultant material.[8] Impressions are a potential vehicle in transmission of infectious agents. Moreover, cast produced from contaminated impressions may themselves be contaminated because microorganisms are able to migrate from impressions into the cast, while setting occurs. The disinfection of impressions and other laboratory fabricated material is more difficult and requires immersion. The agent chosen must not have a deleterious effect on the compression resistance and tear strength of impression materials and must act in reasonable time. So the American Dental Association in 1988, 1991 and 1996, and Council on Dental Materials, Instruments and Equipment in 1988 issued guidelines on disinfecting impressions both by immersion and spray atomization techniques.[8-10]

Since only limited amount of data regarding the effect of immersion and spray atomization techniques on interocclusal recording materials are available in literature, this study intended to see the effect of immersion and spray atomization technique of disinfection on compression resistance of polyvinyl siloxane and polyether interocclusal recording materials.

PROCEDURE

Specimens of the polyvinyl siloxane (Orange bite Bite Registration material, Ref No:5013, Hannover, Germany) and polyether (3M ESPE Ramitec™ Penta™, Seefeld, Germany interocclusal) recording material was prepared according to American Dental Association no 19. Specimens were prepared using a cylindrical stainless steel mold (Fig 1) of appropriate dimension (20mm height and 20mm diameter). The manipulation of polyvinyl siloxane (Fig 2) was done by spreading the material in a cartridge (Orange bite Bite Registration material, Ref No: 5013, Hannover, Germany) along with mixing tip attached to an auto-mixing (3M ESPE DS50 4:1/10:1, Seefeld, Germany) gun injected into the cylindrical mold. The manipulation of polyether specimens (Fig 3) was done in a pentamix (3M ESPE Pentmix™2, Seefeld, Germany) to get a homogenous mix and loaded it into the cylindrical mold. The polyvinyl siloxane and polyether specimens were divided into 3 groups consisting of a control group; a group subjected to spray atomization technique where the specimens were sprayed with the disinfectant until the complete surface of the specimens was wetted for 10 minutes; a group subjected to immersion technique where the specimens was immersed in .525% of sodium hypochlorite (Vensons India, Banglore, India) for 10minutes at room temperature.

The final groups was as follows
Polyvinyl siloxane interocclusal recording material
PVS-CR_A - consisted of Control group without disinfection. (n=10) (Fig 4)
PVS-CR_B - consisted of Immersion technique with .525% sodium hypochlorite for 10 mins. (n=10). (Fig 5)
PVS-CR_C - consisted of Spray atomization technique with .525% sodium hypochlorite for 10 mins. (n=10) (Fig 6)

Polyether interocclusal recording material:
PE-CR_A - consisted of Control group – no disinfection. (n=10) (Fig 7)
PE-CR_B - consisted of Immersion technique with .525% sodium hypochlorite for 10 mins. (n=10) (Fig 8)
PE-CR_C - consisted of Spray atomization technique with .525% sodium hypochlorite for 10 mins. (n =10) (Fig 9)
The specimens were stored in tightly sealed containers and kept for 24 hours before testing for standardization to simulate the time between clinical and laboratory phases.

Compression resistance of the specimens was determined using a Universal Testing Machine (Model: UTE 20, SR NO. 8/99-2546, Fuel instruments and engineers Pvt. Ltd, Maharashtra, India). Each of test specimens was loaded on a Universal Testing Machine (Fig 10) and subjected to a constant compressive force of 25N for a duration of 1min. The specimens were loaded to breakage or failure. This was the compressive load for the specimen.

The compression resistance was calculated as follows
Compression resistance = compressive load (Newton) / cross-sectional area of the specimen (in mm^2)
Compression resistance will be expressed in Megapascals.

Fig 1: Compression Resistance Mold

Fig 2: Polyvinylsiloxane Interocclusal Recording Material.

Fig 3: Polyether Interocclusal Recording Material MDS III[rd year] Postgraduate, Coorg Institute of Dental Sciences, Karnataka, India

Fig 4: Polyvinylsiloxane-Control Group - Compression Resistance

Fig 5: Polyvinylsiloxane Material Subjected To Immersion Technique – Compression Resistance.

Fig 6: Polyvinylsiloxane Material Subjected To Spray Atomization Technique - Compression Resistance.

Fig 7: Polyether-Control Group - Compression Resistance

Fig 8: Polyether Material Subjected To Immersion Technique:-Compression Resistance.

Fig 9: Polyether Material Subjected To Spray Atomization Technique:-Compression Resistance.

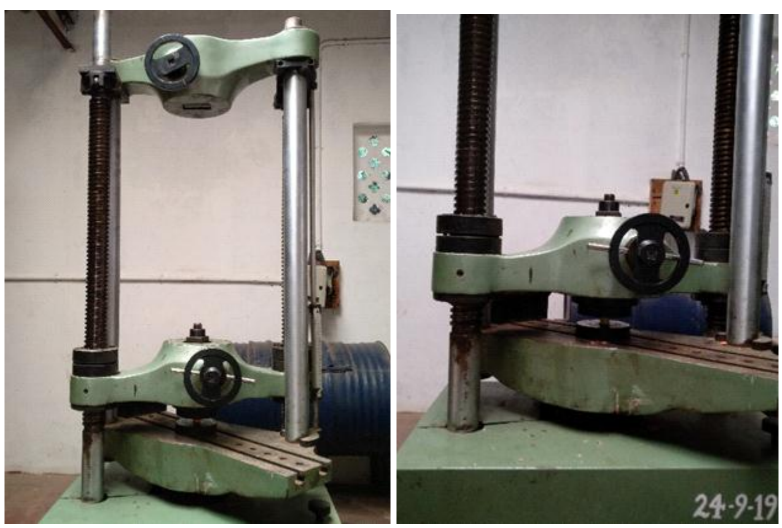


Fig 10: Polyvinyl Siloxane And Polyether Subjected To Compression Resistance On Universal Testing Machine

Results:-

The Compression resistance of specimens were determined using the testing device Universal Testing Machine. The specimens were loaded on to the Universal testing machine and subjected to a constant compressive force of 25N for a duration of 1min. The compression resistance was calculated as follows

Compression resistance = compressive load (Newton) / cross-sectional area of the specimen (in mm^2).

Table 1 shows Comparison of Compression resistance between Control group, Immersion and Spray atomization technique in between polyether and polyvinylsiloxane interocclusal recording material. It was seen that, in the control group, when subjected to compression resistance Polyvinylsiloxane (11.0381MPa) showed greater resistance to compression than Polyether (19.747MPa);When subjected to compression resistance after immersion technique, Polyvinylsiloxane (8.332MPa) showed greater resistance to compression than Polyether (12.3885); When subjected to compression resistance after Spray atomization technique, polyvinylsiloxane (8.773MPa) showed greater resistance to compression than Polyether (9.708MPa). A T value of 15.585 was found to be highly significant at 0.000 level for control group. A T value of 8.712 was found to be highly significant at 0.000 level for immersion technique. A T value of 1.180 was found to be highly significant at 0.000 level for spray atomization.

Table 2 shows Comparison of compression resistance of Polyvinyl siloxane interocclusal recording material between control group, immersion and spray atomization technique using one-way ANOVA and comparison of compression resistance of Polyether interocclusal recording material between control group, immersion and spray atomization technique using one- way ANOVA. Results indicated that, when subjected to compression resistance of polyether interocclusal recording material, the spray atomization technique (9.7080MPa) showed greater resistance to compression than the control group (19.7470MPa) and immersion technique (12.895MPa). An F value of 246.403 was found to be highly significant at 0.000 level. When subjected to compression resistance of polyvinyl siloxane interocclusal recording material, the immersion technique (.77334MPa) showed greater resistance to compression than control group (1.27243MPa) and spray atomization technique (2.46161MPa). An F value of 7.461 was found to be highly significant at 0.000 level.

Table 3 shows significance of compression resistance of polyvinylsiloxane between the control and immersion technique, control and spray atomization technique and immersion and spray atomization technique also significant difference of compression resistance of polyether between the control and immersion technique, control and spray atomization technique and immersion and spray atomization technique using Post Hoc tukeys Test. Results showed that there was a mean difference of 7.3585MPa between control and immersion group which is highly significant; mean difference of 10.0390MPa between control and spray atomization group which is highly significant; mean difference of 2.6805MPa between immersion and spray atomization technique which is highly significant for polyether interocclusal recording material. For Polyvinyl siloxane interocclusal recording material results showed that there was a mean difference of 2.7061MPa between control and immersion group which is highly significant; mean difference of 2.2651MPa between control and spray atomization group which is significant; mean difference of -.4410MPa between immersion and spray atomization technique which is not significant.

Table 1 : Comparison of compression resistance between control group, immersion and spray atomization technique in between polyvinyl siloxane and polyether interocclusal recording material

Compression resistance		Mean (MPa)	Standard deviation	T	Sig.
Controlgroup	Polyvinylsiloxane	11.0381	1.27243	15.585	**0.000 (H.S)**
	Polyether	19.7470	1.22618		
Immersion technique	Polyvinylsiloxane	8.3320	.77334	8.712	**0.000 (H.S)**
	Polyether	12.3885	1.25291		
Spray Atomization technique	Polyvinylsiloxane	8.7730	2.46161	1.180	**0.000 (H.S)**
	Polyether	9.7080	.46509		

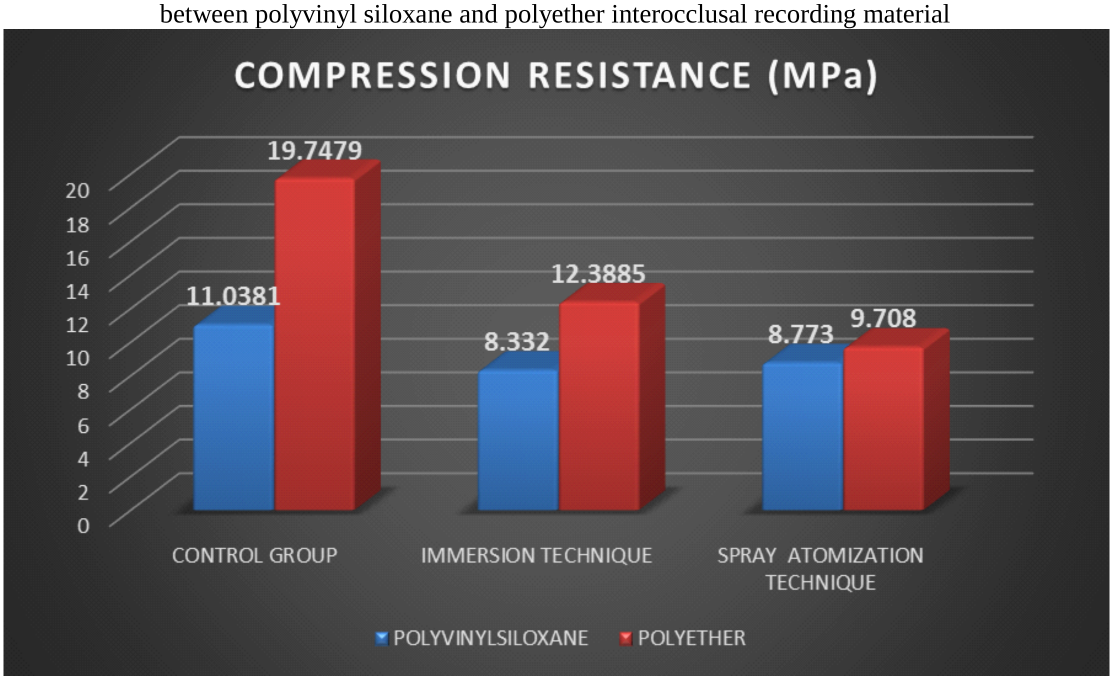
Table 2 : Comparison of compression resistance of polyvinyl siloxane and polyether interocclusal recording material between control group, immersion technique and spray atomization technique using one-way ANOVA

Compression resistance		Mean (MPa)	Standard deviation	F	Sig.
POLYVINYL SILOXANE	Control group	11.0381	1.27243	7.461	**0.002 (H.S)**
	Immersion technique	8.3320	.77334		
	Spray Atomization technique	8.7730	2.46161		
POLYETHER	Control group	19.7470	1.22618	246.403	**0.000 (H.S)**
	Immersion technique	12.3885	1.25291		
	Spray Atomization technique	9.7080	.46509		

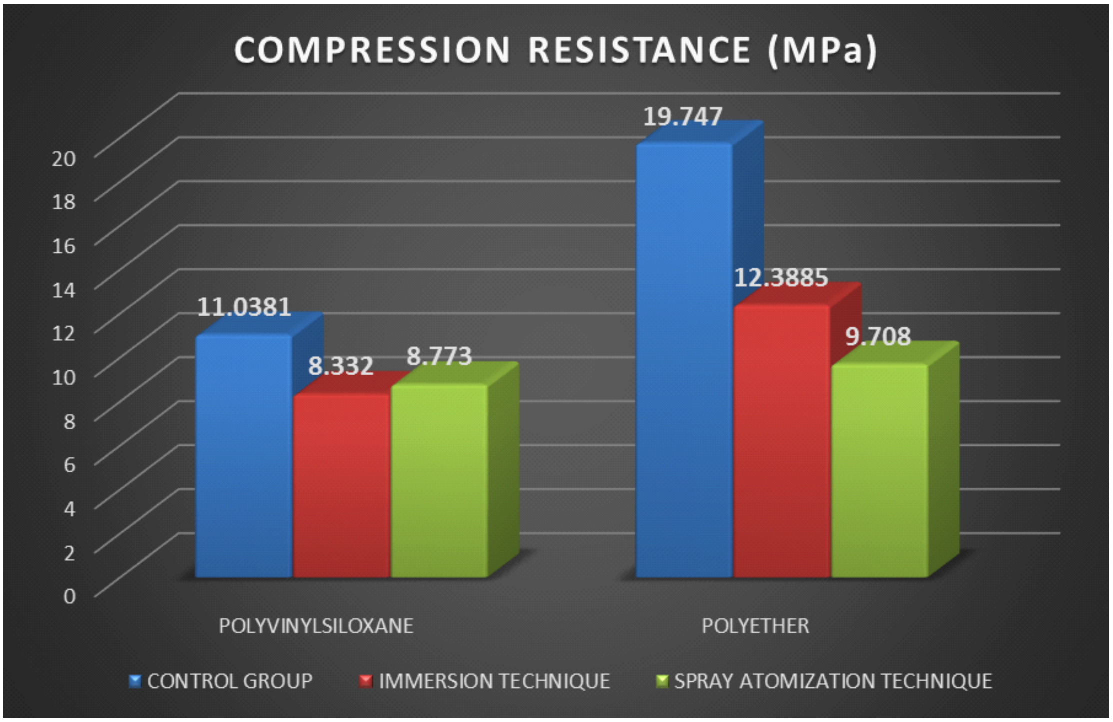
Table 3 : Shows significant difference between the control group, immersion and spray atomization technique in between polyvinyl siloxane and polyether on compression resistance using Post Hoc Tukeys test.

Compression resistance			Mean difference	Standard error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Polyvinyl siloxane	Control group	Immersion technique	2.7061	.74282	.003 (H.S)	.8643	4.5479
		Spray atomization technique	2.2651	.74282	.014 (H.S)	.4233	4.1069
	Immersion technique	Spray atomization technique	-.4410	.74282	.825 (N.S)	-2.2828	1.4008
Polyether	Control group	Immersion technique	7.3585	.46830	.000 (H.S)	6.1974	8.5196
		Spray atomization technique	10.0390	.46830	.000 (H.S)	8.8779	11.2001
	Immersion technique	Spray atomization technique	2.6805	.46830	.000 (H.S)	1.5194	3.8416

Graph 1: Mean compression resistance between control group, immersion technique and spray atomization in between polyvinyl siloxane and polyether interocclusal recording material



Graph 2: Mean compression resistance of polyvinylsiloxane and polyether interocclusal recording material between control group, immersion technique and spray atomization technique using PostHoc Tukeys test**.**



Discussion:-

An interocclusal record is a precise recording of a maxillomandibular position.[1] An interocclusal record is a registration of the positional relationship of the opposing teeth or arches. (GPT- 9).[11] Inaccurate interarch registration leads to errors in diagnosis and treatment.[11] Interocclusal recording of the relationship of the mandible to the maxilla is a simple but complex procedure. The inaccuracies attributed to the interocclusal records can be divided into three main categories: (1) The biologic characteristics of stomatognathic system, (2) Manipulation of the material and (3) The properties of the interocclusal recording materials.[2] To prevent clinical error, the procedure used to record, and fix interocclusal relations should be performed with the utmost care and understanding.[1] The various methods of recording interocclusal relationships are graphic, functional, cephalometric and direct interocclusal recordings. Recording maxillomandibular relationships is an important step in oral rehabilitation. This relationship is transferred to the articulator, so that the laboratory procedures done on the casts will correspond with the patient's mouth.[1]

The forces exerted on these records during removal from mouth or articulation depends on the thickness, properties of the material, the storage, the time interval between making the records, and articulation time affects these changes. Hence, the selection of interocclusal recording material is critical, depending on the situation.[1]

Interocclusal recording materials are partly responsible for accurate precision and occlusal quality of final prosthetic restorations when used for mounting casts on the articulators. Accurate mountings can lead to restorations that require minimal occlusal modifications intraorally, thus reducing the chairside time.[2] Apart from the operator's clinical ability and the technique followed the material used can critically affect the accuracy of interocclusal registration. For making a successful prosthesis, it is important to achieve a harmony between the maxillomandibular relationship and functional anatomy of the patient.[2] The ideal interocclusal recording material should be easy to handle, exhibit minimal dimensional changes during and after setting. It should offer adequate resistance to closure during the mounting of casts.[11]

Polyether and polyvinylsiloxane elastomeric materials are recently been used.[1] Addition silicone impression materials (polyvinylsiloxane) have been widely accepted due to excellent dimensional stability, superior recovery from deformation, and precise detail reproduction.[3] Addition silicone and polyether impression materials have been modified by adding plasticizers and catalyst in order to be used as interocclusal recording media.[2] From the previous studies, it is concluded that wax and zinc oxide eugenol impression paste are not reliable as interocclusal registration materials, because of the great linear changes these materials present even from the first hour and there are possible mounting inaccuracies that may develop if they are not used immediately after the interocclusal registration procedure.[2] 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 set material is then transferred onto casts to be mounted on an articulator.[1] It is essential that the interocclusal record material used for recording centric relation position provides limited resistance before setting to avoid displacing the mandible during closure.[12] Fattore et al compared polyethers with and without a carrier, pink baseplate wax, reinforced wax, and zinc oxide-eugenol paste, and concluded that the polyether without a carrier was the most reliable interocclusal material in his study.[12] Addition silicones (polyvinyl siloxanes) exhibit the least amount of distortion when compared with other elastomeric impression materials.[12] Accuracy, stability after setting, minimal resistance to closure, and easy manipulation (because there is no need for a carrier) are the main advantages of addition silicones as interocclusal record materials.[12]

There is no material, however, that has all the properties of the ideal interocclusal registration medium. These properties have been described as having:

1. Limited initial resistance to closure (in order to avoid the displacement of mobile teeth or of the mandible during record making).
2. Dimensional stability after setting.
3. Resistance to compression after polymerization.
4. Ease of manipulation.
5. Absence of any adverse effects on the tissues involved in the recording procedures.
6. Accurate recording of the incisal or occlusal surface of the teeth.
7. Ease of verification.[13]

In clinical practice it seems that the polyether will display less resistance during the interocclusal registration procedures. As a result, displacement of mobile teeth or of mandible should be less frequent. A lengthy setting time is not a desired property for the registration of maxillomandibular relations, because it can affect the precision due to possible movement of the mandible. This movement can occur because of the patient's inability to maintain the mandible in one position.[13]

Guidelines set by the American Dental Association (ADA) and the Centers for Disease Control (CDC) suggest that all surfaces that have been splashed or touched by human body fluids be disinfected with a hospital-grade disinfectant with the Environmental registered Protection Agency. The surface of elastomeric impressions, routinely made in restorative dentistry, generally contact saliva and blood, allowing transfer of viruses to the stone cast.[14] Interocclusal registration materials acts as a significant source of cross contamination, so these must be disinfected immediately after their removal from mouth. There are two important factors to consider when choosing a disinfectant namely, its ability to eliminate microbial contamination and its effect on the resultant material.[8]

So the American Dental Association in 1988, 1991 and 1996, and Council on Dental Materials, Instruments and Equipment in 1988 issued guidelines on disinfecting impressions both by immersion and spray atomization techniques.[8-10] The performance of sodium hypochlorite is based on cell oxidation. A study by Silva and Salvador Frederick et al and Drennon et al showed that disinfection of impression by spray appeared to be as efficacious as immersion and unlike the immersion method, it does not cause any dimensional changes.[14] Guidelines suggested that addition silicone impression can be disinfected by immersion without affecting accuracy and detail reproduction. Times for disinfection vary, so information supplied with the disinfectant should be consulted to determine the proper time. Polyether impressions may be adversely affected with disinfection by immersion. To minimize dimensional change with polyether impressions, a chlorine compound product with a short disinfection time should be selected or the impressions should be disinfected with a spray.[9] Since the compatibility of an impression material with a disinfectant varies, manufacturer's recommendations for proper disinfection should be followed. The use of disinfectants requiring times of no more than 30 minutes for disinfection is recommended.[10]

One of the most desirable characteristics of the interocclusal registration material is resistance to compression after polymerization.[2] The resistance to compression after setting is a very desirable property for interocclusal recording media. Maxillomandibular relationships that were registered correctly in the patient can be erroneously transferred in the mounting procedures because of the compressibility of the materials. If a material is compressible, it can be distorted by faulty manipulation by the operator or by the weight of the cast to be mounted. The clinicians should choose interocclusal registration materials that display the least possible elastic or torsion due to compression from a load. Of all the materials tested, polyvinylsiloxane presented the greatest resistance to compression.[15] 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.[2] A compressive force is commonly exerted on the recording material during the articulation procedure which may cause inaccuracies during mounting of casts. Each of these interocclusal recording materials exhibits a degree of deformation when compressed under a load. The deformation may vary with the thickness and the properties of the recording materials used.[4]

The testing of the resistance to compression after setting was performed following a modification of the method described in A.D.A specification no 19 for the elastomeric impression materials.[1,15] For standardization, the specimens were stored at room temperature for 24hrs to simulate the time between clinical and laboratory phases.[2] Rubber bands are commonly used to sustain the contact of opposing casts during mounting procedures. The maximal force exerted by use of one office standard rubber band (No.19) to a position a maxillary cast to a mandibular cast mounted on an articulator was approximately 25 N, so this value was selected in the investigation.[2] A limited thickness of recording material is usually indicated between prepared teeth on one arch opposing an unprepared dental arch compared with a thickness of material between two opposing edentulous arches.[16] It has been stated that if these interocclusal recordings are used for mounting working cast in fabrication of prosthesis, the casts should be secured in a record, in a manner that ensures complete seating but exerts a minimal compressive force.[16] Thickness of interocclusal record is lesser in fixed partial denture cases. It is more in complete denture cases.[11] Proper interocclusal records minimizes preinsertion adjustments to the restorations and saves chair side time or repetition of some clinical and technical stages.[1]

In the present study, polyvinylsiloxane interocclusal recording material showed the greatest resistance to compression when compared with polyether interocclusal recording material when subjected to immersion technique (8.332MPa) and spray atomization technique (8.773MPa) and the control group (11.0381MPa). The reason for greater compression resistance of polyvinylsiloxane may be because of its low dimensional change when compared to other bite registration material.[1,2] This observation was in correlation with the studies of Breeding LC, Dixon DL who showed that Blue Mousse polyvinylsiloxane displayed the greatest resistance to compression as compared to other elastomeric interocclusal recording materials in their study.[2] In this study polyvinylsiloxane showed greater resistance to compression when compared to polyether at 20mm thickness. It exhibited minimal distortion during compression and hence can give the clinician the opportunity to make only minimal adjustments to the restoration that will be delivered from the laboratory and avoid unnecessary use of chair time or repetition of some clinical and technical stages.[2]

Studies done by Craig RG and Sun Z, Chai J, Tan E and Pang IC, Campos AA and Nathanson D have also shown that PVS interocclusal recording material was more accurate and dimensionally stable than polyether interocclusal recording material.[1] Tripodakis et al suggests that these records should possess adequate rigidity to resist deformation by the casts (compression resistance). Excessive forces cause the casts to be placed too close and inadequate forces cause the casts to be mounted too far apart. Researchers have suggested a force of 20- 25 Newton for one minute for evaluating the compressive resistance.[4] These results also suggested that if these interocclusal recordings are used for mounting working casts in fabrication of the prosthesis the casts should be secured in a manner that ensures complete seating but exerts a minimal compressive force.[16] In this study polyether has been shown less compression resistance than polyvinylsiloxane may be because of a “Spring” to this elastomer that can cause articulated casts to “open” in the centric closure position. If polyether is not trimmed and carefully seated on the casts, it can be more inaccurate than any other material examined in the study.[11] Nevertheless, the potential error introduced by the use of more compression resistant materials would be acceptable if casts were mounted for diagnostic evaluation of partially edentulous patients.[16] On the basis of result seen in Table 1, in the control group, when subjected to compression resistance polyvinylsiloxane

(11.0381MPa) showed greater resistance to compression than polyether (19.747MPa); When subjected to compression resistance after immersion technique, polyvinylsiloxane (8.332MPa) showed greater resistance to compression than polyether (12.3885MPa); When subjected to compression resistance after spray atomization technique, polyvinylsiloxane (8.773MPa) showed greater resistance to compression than polyether (9.708MPa). A T value of 15.585 was found to be highly significant at 0.000 level for control group. A T value of 8.712 was found to be highly significant at 0.000 level for immersion technique. A T value of 1.180 was found to be highly significant at 0.000 level for spray atomization.

When polyvinylsiloxane interocclusal recording material was subjected to compression resistance, the immersion technique (.77334MPa) showed better than control group (1.27243MPa) and spray atomization technique (2.46161MPa). An F value of 7.461 was found to be highly significant at 0.000 level. It might be due to the addition of surfactants to improve its ability to reproduce details. The presence of these agents improves the compatibility with water and increases the sorption of water when impressions are immersed.[8] Impressions can be disinfected by immersion in any compatible disinfecting product. Since the compatibility of an impression material with a disinfectant varies, manufacturer's recommendations for proper disinfection should be followed. The use of disinfectants requiring time of not more than 30 minutes for disinfection is recommended according to JADA.[10] Current ADA guidelines state that the impression should be rinsed to remove saliva, blood, and debris, followed by immersion in a disinfecting product, such as hypochlorite, iodophor, glutaraldehyde, or phenol. According to the Organization for Safety and Asepsis Procedures, the recommended exposure time for most surface disinfectants is 10–15 minutes.[17]

Also it has been seen that the surface quality of polyvinlysiloxane will not be much affected by sodium hypochlorite after 10 minutes or 1 hour immersion, in contrast polyether surface quality was significantly affected by sodium hypochlorite immersion with a mottled surface on 30% of the impressions after 10 minute immersion and a matte/sticky surface on 100% of the polyether impressions after 1hr immersion. This would suggest that in addition to NaOCl absorption by polyether, there might be an adverse interaction between NaOCl and polyether resulting in impression surface degradation.[17] Merchant also warns that polyether should be disinfected for short periods with the disinfectants accepted by the ADA, which in turn recommends immersion not exceeding 30 minutes.[18] The performance of sodium hypochlorite is based on cell oxidation. A study by Silva and Salvador, Frederick et al. and Drennon et al. showed that disinfection of impression by spray appeared to be as efficacious as immersion and unlike the immersion method, it does not cause any dimensional changes.[14] Polyether shows varied dimension with sodium hypochlorite when immersed for more than 10min. Since sodium hypochlorite is both an oxidizing and hydrolyzing agent they are strongly alkaline, hypertonic, and typically have normal concentrations of 10 to 14% available chlorine. They deteriorate with time, exposure to light, temperature, and contamination with metallic ions. Chlorine compound is highly reactive and could react and fix on the material. The dimensional change might be due to reaction of chlorine compound with sulfonic ether which interferes with the polymerization reaction and produces distortion.[8] Bustos et al revealed that patient-derived silicone specimens showed complete elimination of bacteria after being subjected to 2% GA and 0.5% SH for 10 minutes.[19] A study done by Matyas et al showed that there was no significant changes when the silicone or vinylpolysiloxane impressions were sprayed or immersed in five viricidal agents.[20]

When subjected to compression resistance of polyether interocclusal recording material, the spray atomization technique (9.7080MPa) showed better resistance to compression than the control group (19.7470MPa) and immersion technique (12.895MPa). An F value of 246.403 was found to be highly significant at 0.000 level. Immersion technique of disinfection is not usually indicated for polyether material as there are chances for a mottled surface/matte or a sticky surface to form because of the presence of chlorine compounds which could react and fix on material.[6,17] Hence sodium hypochlorite had significantly affected polyether. Therefore, spray atomization technique can be recommended for polyether disinfected with sodium hypochlorite, to preserve dimensional stability, whereas both spray or immersion technique can be safely used with addition silicone. For polyether interocclusal record, restrictions based on type, duration, and method of disinfection must be applied to preserve the accuracy of the impression and effective microbial elimination.[8]
Significance of compression resistance of polyvinylsiloxane between the control and immersion technique and spray atomization technique and immersion and spray atomization technique also significant difference of compression resistance of polyether between the control and immersion technique, control and spray

atomization technique and immersion and spray atomization technique using Post Hoc tukeys test was seen. Results showed that there was a mean difference of 7.3585Mpa between control and immersion group which is highly significant; mean difference of 10.0390MPa between control and spray atomization group which is highly significant; mean difference of 2.6805MPa between immersion and spray atomization technique which is highly significant for polyether interocclusal recording material. For Polyvinyl siloxane interocclusal recording material results showed that there was a mean difference of 2.7061MPa between control and immersion group which is highly significant; mean difference of 2.2651MPa between control and spray atomization group which is significant; mean difference of -.4410MPa between immersion and spray atomization technique which is not significant. Graph 1 shows that polyvinyl siloxane interocclusal recording material is least resistant to compression than polyether interocclusal recording material when subjected to compression resistance after immersion and spray atomization technique of disinfection. Graph 2 indicates that immersion technique of disinfection proved to be better for polyvinylsiloxane interocclusal recording material and spray atomization technique of disinfection was shown to be better for polyether interocclusal recording material.

A few limitations of the study are

1. There was no simulation of intra-oral mouth temperature during the setting of the materials.
2. It should be mentioned that in clinical practice the thickness of material is never 20mm. It ranges between 2-4mm, depending on whether occlusal clearance was provided to one or both arches.11,12 Since it has shown that thicker elastomeric interocclusal occlusal registration material are generally more compressible, it should be noted that further research is needed in order to evaluate the compressibility of interocclusal recording material in thickness similar to those of simulated clinical conditions.[12]
3. Another point of interest is the ongoing polymerization reaction of the elastomeric materials, even after 30mins. This continued setting process may result in increased surface hardness as shown by Chai et al and may affect the resistance to compression as well.

Conclusion:-

1. Immersion technique could be indicated for polyvinylsiloxane interocclusal recording material when subjected to compression resistance because its low dimensional change when compared to other bite registration material.
2. Immersion technique is not indicated for polyether interocclusal recording material when subjected to compression resistance as polyether showed varied dimension with sodium hypochlorite when immersed for 10min.
3. Spray atomization technique can be indicated for polyether interocclusal recording material when subjected to compression resistance as it helps in preserving the dimensional stability.
4. Spray atomization technique can be indicated for polyvinylsiloxane interoclusal recording material when subjected to compression resistance because of its greater dimensional stability.
5. When subjected to compression resistance after the immersion and spray atomization technique of disinfection between the polyvinyl siloxane and polyether interocclusal recording material, the polyvinyl siloxane showed greater resistance to compression with immersion technique when compared to polyether interocclusal recording material. Immersion technique was shown to be better for polyvinylsiloxane interocclusal recording material while spray atomization technique proved to be better for polyether interocclusal recording material.

References:-

1. Chandu GS, Khan MF, Mishra SK, Asnani P. Evaluation and comparison of resistance to compression of various interocclusal recording media: an in vitro study. J Int Oral Health. 2015 May;7(5):24-9.
2. Nagrath R, Lahori M, Kumar V, Gupta V. A comparative study to evaluate the compression resistance of different interocclusal recording materials: an in vitro study. J Prosthet Dent. 2014 Dec;14(1):76-85.
3. Lu H, Nguyen B, Powers JM. Mechanical properties of 3 hydrophilic addition silicone and polyether elastomeric impression materials. J Prosthet Dent. 2004 Aug 1;92(2):151-4.
4. Dua P, Gupta SH, Ramachandran S, Sandhu HS. Evaluation of four elastomeric interocclusal recording materials. Med J Armed Forces India. 2007 Jul;63(3):237-40.
5. Lawson NC, Burgess JO, Litaker M. Tear strength of five elastomeric impression materials at two setting times and two tearing rates. J Esthet Restor Dent. 2008 Jun;20(3):186-93.
6. American Society for the Testing of Materials. Standard Test methods for tear strength of conventional vulcanized rubber and thermoplastic elastomers [ASTM D 624-00]. American National Standards Institute.West Conshohocken, Pa; Annual book of ASTM Standards;2000.p.133-41.

7. Webber RL, Ryge G. The determination of tear energy of extensible materials of dental interest. J Biomed Mater Res.1968 Sep;2(3):281-96.
8. Gounder R, Vikas BV. Comparison of disinfectants by immersion and spray atomization techniques on the linear dimensional stability of different interocclusal recording materials: An in vitro study. Eur J Dent. 2016 Jan;10(1):7-15.
9. Council on dental materials, instruments and equipment's, Council on dental practice, Council on dental therapeutics. Infection control recommendations for the dental office and the dental laboratory. J Am Dent Assoc. 1988 Feb;116(2):241-8
10. ADA Council on Scientific Affairs and ADA Council on Dental Practice. Infection control recommendations for the dental office and the dental laboratory. 1996 May;127(5):672-80.
11. Gupta S, Arora A, Sharma A, Singh K. A Comparative Evaluation of Linear Dimensional Change and Compressive Resistance of Different Interocclusal Recording Materials-An Invitro Study. Indian J Dent Sci. 2013 Oct 1;5(4):32-7.
12. Campos AA, Nathanson D. Compressibility of two polyvinyl siloxane interocclusal record materials and its effect on mounted cast relationships. J Prosthet Dent. 1999 Oct 1;82(4):456-61.
13. Michalakis KX, Pissiotis A, Anastasiadou V, Kapari D. An experimental study on particular physical properties of several interocclusal recording media. Part I: consistency prior to setting. J Prosthodont. 2004 Mar;13(1):42-6.
14. Drennon DG, Johnson GH, Powell GL. The accuracy and efficacy of disinfection by spray atomization on elastomeric impressions. J Prosthet Dent. 1989 Oct 1;62(4):468-75.
15. Michalakis KX, Pissiotis A, Anastasiadou V, Kapari D. An experimental study on particular physical properties of several interocclusal recording media. Part III: resistance to compression after setting. J Prosthodont. 2004 Dec;13(4):233-7.
16. Breeding LC, Dixon DL. Compression resistance of four interocclusal recording materials. J Prosthet Dent. 1992 Dec 1;68(6):876-8.
17. Walker MP, Rondeau M, Petrie C, Tasca A, Williams K. Surface quality and long-term dimensional stability of current elastomeric impression materials after disinfection. J Prosthodont. 2007 Sep;16(5):343-51.
18. Adabo GL, Zanarotti E, Fonseca RG, dos Santos Cruz CA. Effect of disinfectant agents on dimensional stability of elastomeric impression materials. J Prosthet Dent. 1999 May 1;81(5):621-4.
19. Jeyapalan V, Krishnan CS, Ramasubramanian H, Sampathkumar J, Azhagarasan NS, Krishnan M. Comparative Evaluation of the Antimicrobial Efficacy of Three Immersion Chemical Disinfectants on Clinically Derived Poly (Vinyl Siloxane) Impressions. J Prosthodont. 2016 May 30;27(5):469-75.
20. Matyas J, Dao N, Caputo AA, Lucatorto FM. Effects of disinfectants on dimensional accuracy of impression materials. J Prosthet Dent. 1990 Jul 1;64(1):25-31.