

Inter-occlusal record materials used in Prosthodontic Rehabilitations: A Literature Review

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Abstract: To achieve a successful prosthesis it is important to achieve harmony between the maxillomandibular relationship and anatomy of patient. Thus, it is essential to record this relationship with the least possible error to obtain a successful prosthesis. The ideal material-technique combination for making interocclusal records would allow the placement of indirectly fabricated prostheses in the patient's mouth with no occlusal adjustment and hence play a major role in the success of the rehabilitative procedures in terms of function and esthetics. His article reviews various interocclusal record materials.

INTRODUCTION

The interocclusal registration material records the occlusal relationship between the natural and / or artificial teeth for planning occlusal rehabilitation and for construction of removable and fixed partial dentures. The goal in the success of removable and fixed partial denture is achieved when maxillomandibular centric relation is recorded accurately. The material used to establish and to record this relationship is very important factor in the accuracy of record, which can affect the validity of centric relation record 1, 2.

Ideal Requirements of Interocclusal Bite^{3,4,5} Registration Materials:

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

Types of Interocclusal Recording medium^{1, 2, 3, 4,5}

1. Plaster of paris.
2. Waves.
3. Zinc oxide eugenol pastes.
4. Silicone elastomers.
5. Polyether elastomers.
6. Acrylic resins.

1. Impression Plaster (Type I Gypsum)¹⁻⁶

Impression plaster is basically plaster of paris to which modifiers have been added. These modifiers accelerate setting time and decrease setting expansion.

Composition	:	Calcium sulphate hemihydrate.
Water powder ratio	:	0.75 to 0.50
Mixing time	:	20 to 30 seconds
Working time	:	5 minutes
Initial setting time	:	Approximately 9 minutes

Advantage : Records of impression plasters are accurate, rigid after setting and do not distort with extended storage.

Disadvantage : Impression plaster is difficult to handle because material is fluid and unmanageable prior to setting.

Technique : Transfer copings are made. Impression plaster is applied over the top of copings and the patient is asked to close in centric relation. The impression plaster on the adjacent teeth is cut away so that a rectangular contact area in plaster remains. Undertake due to adverse tooth contours are reduced to assure removal of the plaster without chipping or cracking the record. Right angle cuts are made on buccal and lingual / palatal indices of the teeth adjacent to the copings are made. The interocclusal record and the buccal and lingual / palatal indices are removed and are reassembled. The dies are positioned in the record and a master cast is poured.

2. Waxes¹⁻⁹

The bite registrations are frequently made from 28 gauge costing wax or from basepaste wax, specially formulated from bee wax or hydrocarbon waxes such as paraffin or creasine. The thermoplastic waxes are frequently used for interocclusal registration or as a carrier for registration. Combination of Alu wax base plate was reinforced with Ash no.7 metal sheath is also being used. They have been used in the shape of quadrant strips or segments, horse shoe shape wafers and complete or partial arch wafers. Waxes can be applied directly in sheet form or they can be laminated over tinfoil and gauze.

Flow : The flow of several bite registration waxes at 37°C ranges from 2.5% to 10% indicating that these waxes are susceptible to distorting on removal from mouth.

Advantage : A major factor in popularity is clinical flexibility of waxes and accounts for the broad range in which records can be modified, changed, corrected and verified with comparative ease.

Disadvantage : However studies have demonstrated that wax interocclusal records are inaccurate, unstable, inconsistent because they can interfere with passive and active mandibular movement that is they resist to the closure.

Technique : A wax interocclusal centric relation record is made before the abutments are prepared. Then the abutments are prepared and another interocclusal record is made with a half of sheet of softened wax. The wax is molded into the shape of the dental arch and is positioned on the teeth and the patient is asked to close the jaws or, the mandible is guided into centric relation. Then patient is asked to open and close the mouth several times. The distinct sound of tooth percussion should be heard. The wax is cooled with water, while the teeth are held together, the patient is asked to open the mouth and the wax is cooled further. The total cooling must be at least two minutes. The wax record is removed from the mouth and is allowed to cool for one minute under running water. The wax record is trimmed for possible interferences and is returned to the mouth. The trimming for possible interferences is done by shaving the wax with a sharp blade to prevent its distortion. The seating of record on the teeth and closure must be precise. The registration is compared with the record made prior to abutment preparation. The wax record is stored on the opposing cast and is kept in a cool place.

3. Zinc oxide Eugenol Paste^{1-6, 10}

Zinc oxide Eugenol paste is an effective interocclusal registration material.

Composition :

Tube I (Base)	Tube II (Accelerators)
Zinc oxide 87%	Oil of cloves or eugenol 12%
Fixed vegetable 13%	Gum polymerised resin 50%
Or mineral oil	
	Filler 20%
	Lonslon 3 %
	Resinous balsam 10%
	Accelerator solution (CaCl ₂) 5%
Mixing time	: Approximately 1 minute
Setting time	: 10 minutes
Dimensional stability	: A negligible shrinkage lesser than 0.1% may occur during hardening

Advantages : Fluidity before setting – Fluidity is a critical quality of an interocclusal registration material because it ensures minimal interference with mandibular closure during record making procedures.

- Adhesion to its carrier.
- Rigidity and inelasticity after final set.
- Accuracy in recording occlusal and incisal surfaces of the teeth.
- High degree of repeatability.

Disadvantages :

- Lengthy setting time.
- Significant brittleness ?
- Accuracy of the registration material may surpass the accuracy of the casts resulting in proper fit.

Technique : A Jones frame with a Kerr Bilb is used to carry the paste into position between the teeth. Sufficient paste is mixed to cover both sides of the gauze and to register half of the length of the abutments and at least one adjacent tooth. The frame is placed distal to the last tooth to prevent impingement upon the metal of the frame. The patient is asked to close in centric relation. The record is removed from mouth after the paste has set. The interocclusal record is then removed from the frame and is used for mounting the cast.

4. Silicone Elastomers : ^{1-4,10,11}

Two types of elastomers are available as interocclusal registration materials.

1. Addition silicone
2. Condensation silicone.

1. Addition silicone

Composition :

Base Paste

Polymethyl hydrogen siloxane
 Siloxane prepolymers
 Fillers

Catalyst Paste

Divinyl polydimethyl siloxane
 Siloxane pre polymers
 Fillers

If the catalyst paste contains the platinum salt activator, then the base paste must contain the hybrid silicone. Retarders may also be present in the paste that contains catalyst.

Mean working time	:	At 23°C 3.1 min	At 37°C 1.8 min
Mean setting time	:	At 23°C 8.9 min	At 37°C 5.9 min

2. Condensation silicone

Composition :

Base paste

Tetraethyl orthosilicate

Catalyst paste

Stannous acetate

Ethyl alcohol is a by-product of condensation setting reaction. Its subsequent evaporation probably accounts for much of the contraction that takes place in a set silicone.

Mean working time	:	At 23°C 3-3 min	At 37°C 2-5min
Mean setting time	:	At 23°C 11 min	At 37°C 8-9 min

Addition silicone has gained acceptance because it is more stable than condensation silicone.

Advantages :

- Accuracy
- Stability after setting.
- Minimal Resistance to closure.
- Does not require a carrier.

Disadvantage :

- Resistance to compression of a set material which contributes to difficulty.

Technique :

Take equal amount of base paste and catalyst paste and mix according to manufacturers instructions obtaining a streak free mixture. Load the syringe by maintaining a slight angle while scraping the pad. Place the material over the occlusal surface of teeth. Guide mandible to centric and ask patient to occlude wait for final set according to manufacturers instructions. Trim the excess and recheck the record.

5. Polyether Elastomer ^{1-3,6,12} :

Polyether interocclusal registration materials are supplied as two paste systems.

Base paste : Low molecular weight polyether with ethylene amine terminal group along with fillers such as colloidal silica and plasticizer such as glycolether or phthalate.

Catalyst paste : An aromatic sulfonic acid ester plus a thickening agent to form a paste along with fillers.

Mean working time	:	At 23°C	At 37°C
		3-3 min	2-3min
Mean setting time	:	At 23°C	At 37°C
		9-0 min	8-3 min

Advantages :

- Accuracy
- Stability after polymerization and during storage.
- Fluidity and minimal resistance to closure.
- Doesnot require carrier.

Disadvantage :

- Resiliency and accuracy may exceed the accuracy of plaster casts.

Technique :

Take equal amount of base paste and catalyst paste and mix according to manufacturers instructions obtaining a streak free mixture. Load the syringe by maintaining a slight angle while scraping the pad. Place the material over the occlusal surface of teeth. Guide mandible to centric and ask patient to occlude wait for final set according to manufacturers instructions. Trim the excess and recheck the record.

6. Acrylic Resin : ^{1-5,11,13-19}

The most frequent application of acrylic resin for interocclusal records is the fabrication of single stop centric occlusion records.

Composition :

Powder	- Polymer	- Polymethyl methacrylate benzyl peroxide.
Liquid	- Monomer	- Methyl methacrylate
	- Tertiary amine	- Dimethyl para toluidine

Initial hardening time : 30 minutes.

Advantages : Accurate and rigid after setting.

Disadvantage : Polymerization shrinkage.

Technique :

Apply petroleum jelly over occlusal surfaces of teeth. Measure monomer and polymer according to manufacturers recommendations wait until dough stage is reached. Form dough patty into a flattened shape approximately 2mm thick. Keep it over occlusal surfaces of teeth. Guide mandible to centric position and ask patient to occlude. Wait for final set according to manufacturers instructions. Trim the excess and recheck the record.

SUMMARY & CONCLUSION

An inter occlusal record is a precise recording of maxillomandibular position it should be capable of maintaining extreme accuracy even under such varying condition as storage and handling even though a record may appear to be fixed and accurate it may still undergo dimensional changes which can only be evaluated microscopically the clinical change in interocclusal record can be only evaluated by dentist or by the patient in reference to high points.

The cause of occlusal discrepancies attributable to the interocclusal record can be divided into three categories one cause is related to biologic characteristics of stomatognathic system, a second cause is attributed to iatrogenic errors and third cause is associated with the properties of interocclusal recording material.

To avoid diagnostic treatment errors conducted with meticulous attention to manipulation of these materials with specific instruction for each material. The ideal material technique combination for making interocclusal records would allow the placement of indirectly fabricated prosthesis in patients mouth with no occlusal adjustments.

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