Recent interocclusal record material for prosthetic rehabilitation - A literature review

B. Deepthi1, V Rakshagan2, Ashish R. Jain2*

ABSTRACT

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.

KEY WORDS: Anterior stop, Interocclusal records, Interocclusal recording techniques, Lucia jig, Occlusion

INTEROCCLUSAL RECORD MATERIALS[1-3]

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 RECORD MATERIALS [Figure 1]

- Alginate impression material.
- Zinc oxide eugenol paste.
- Corrected wax.
- Metalized wax.
- Elastomers.
- Impression plaster.
- Acrylic resin.
- T-scan.
- Pressure-sensitive films.
- Typewriter ribbon.
- Transparent acetate sheet.
- Occlusion sonography.

1Department of Prosthodontics and Implant Dentistry, Saveetha Dental College, Saveetha University, Chennai, Tamil Nadu, India.
2Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha University, Chennai, Tamil Nadu, India

*Corresponding author: Dr. Ashish R. Jain, Department of Prosthodontics, Saveetha Dental College and Hospital, Saveetha University, Ponamalle High Road, Chennai - 600 127, Tamil Nadu, India. Phone: +91-9884233423. E-mail: dr.ashishjain_r@yahoo.com

Received on: 22-03-2018; Revised on: 27-04-2018; Accepted on: 30-05-2018
ALGINATE IMPRESSION MATERIAL

Korioth reported on the number and location of occlusal contacts in intercuspal position using alginate impression material.[4] A technique suggested and used by Ingervall, using indexes of alginate (irreversible hydrocolloid) impression material were applied to record the number and location of posterior occlusal tooth contacts including canines. The selected subjects were asked to rest their backs and heads on a reclined dental chair (approximately 30° to the floor). After spatulation, the impression material was applied to the occlusal surfaces of all lower canines, premolars, and molars on both sides. Subjects were instructed to close the mouth gently and occlude the teeth together with moderate pressure until the impression material was set. Impressions were made on the same day. After their careful removal, the left and right indexes were examined against light, and the number and location of perforations were registered as occlusal tooth contacts for each subject.[2,3]

MODELLING WAX

It is the most versatile and most commonly used interocclusal recording material. The reason for its 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 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.[3,4]

ZINC OXIDE EUGENOL PASTE

It is generally used as interocclusal recording material. Due to the fluidity of paste before setting, it offers minimal resistance with mandibular closure and becomes rigid after it sets finally. However, zinc oxide eugenol paste has a lengthy setting time, significant brittleness; they stick to the teeth and have unreliability to reuse. As it sets by chelation reaction, the by-products formed may undergo evaporation, leading to dimensional change. Vital portions of the record can be lost through breakage on removal from the mouth. Once zinc oxide eugenol record has been used to mount the casts, it is rarely used again. Unless trimmed, flash around the teeth can prevent the accurate seating of casts. Thus, it is advisable to use a minimal amount of zinc oxide eugenol to avoid excess flash. Therefore, zinc oxide eugenol was added to wax impression in a very thin layer to improve poor detail transfer and displacement of wax.[4,6]

CORRECTED WAX

In corrected wax interocclusal recording material, interocclusal record made with wax is corrected with zinc oxide eugenol material. It improves the detailed recording and displacement of wax, but it increases the vertical dimension. While making record with corrected wax, they used double sheet of the base plate wax and the record is made. After the removal of record from mouth, thin layer of zinc oxide eugenol was applied over the wax record and placed intraorally until material is hardened.

METALIZED WAX

The metalized wax wafers (aluminum particles) are found to be much more accurate than non-metalized wax as the addition of metal particles (aluminum) to the modeling wax make it more conductive which may lead to increase in the accuracy of the record.[6]

ELASTOMERS

Elastomers are the most dimensionally stable materials till yet. Elastomers 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, set to a consistency that makes them easy to trim without distortion, and accurately reproduce tooth details. Furthermore, among

![Figure 1: Represents the various interocclusal record materials](http://example.com/image.png)
the elastomers, addition silicones exhibit least amount of distortion. The excellent dimensional stability of addition silicones is attributed to the fact that it sets by addition polymerization reaction. Therefore, no by-products and no loss of volatiles occur in addition silicones. Accuracy, minimal resistance to closure, and easy manipulation are the main advantages of addition silicones as interocclusal recording material. However, its major disadvantage is that any compressive force exerted on these materials during mounting procedures may cause inaccuracies during mounting of the casts. Spring action found in these materials caused the articulated cast to open in centric relation position. Thus, the records should be trimmed and carefully seated over the occlusal surface to minimize the negative spring action [Figure 2].

POLYETHER ELASTOMER

Polyether interocclusal registration material consists of the basic impression material augmented by plasticizers and fillers. The advantages of this material as an interocclusal registration material are accuracy, stability after polymerization and during storage, fluidity, and minimal resistance to closure, can be used without a carrier. Disadvantages are that resiliency and accuracy may exceed the accuracy of the plaster casts. Both of these factors can interfere with the placement of the plaster cast into the recording medium during mounting procedures. The records are trimmed to remove excess material and preserve only the teeth indentations, avoiding distortions.

IMPRESSION PLASTER

Impression plaster is basically plaster of Paris with modifiers. Modifiers accelerate setting time and decrease setting expansion. Records of impression plaster are accurate, rigid after setting, and do not distort with extended storage. It is difficult to handle because the material is fluid and unmanageable before setting. The final interocclusal record is brittle.

ACRYLIC RESIN

The most frequent application of acrylic resins for interocclusal records is in the fabrication of single stop centric occlusion records. Acrylic resin is both accurate and rigid after setting. Disadvantages of acrylic resin as an interocclusal registration material include dimensional instability due to continued polymerization resulting in shrinkage; rigidity of the material can damage plaster cast and dies during mounting on the articulator.

TECHNIQUES USED FOR INTEROCCLUSAL RECORDS

Dawson’s Technique

He used bimanual manipulation to guide the mandible to centric relation [Figure 3].

a. Wax bite record: A brittle hard wax is used for this technique. Wax is softened and placed against the upper arch to indent it. The mandible is manipulated to CR and patient closes into wax. Keep upward loading compression on the condyles as the patient closes; otherwise, the patient may protrude the jaw. There should be no impingement into soft tissues.

b. Anterior stop technique: When the mandible is closed, the lower incisors strike against a stop that is precisely fitted against the upper incisors [Figure 4]. The stop should be thin enough so that the first point of tooth contact barely misses but under no circumstances should any posterior tooth be allowed to contact when the anterior stop is in place. A firm setting bite registration paste is injected between the posterior teeth and allowed to set.
Triple Tray Technique
A plastic registration frame (triple bite impression tray) is used in this method to carry the interocclusal registration material [Figure 5]. The frame is tried in the mouth on the side with the prepared teeth. Trim away the film that covered the unprepared teeth. Apply the bite registration material evenly on to both top and bottom of the frame and insert the tray in the mouth, centering the loaded portion over the prepared tooth or teeth. Cut excess material that extends over the unprepared teeth adjacent to preparation. Remove the excess thickness of the record so that only the imprint of cusp tip should remain. The part of the record facial to the mandibular buccal cusp tips is cut off all the way through the posterior member of the frame, and the facial segment of the record is discarded.

Enamel Island Method
This method preserves a centric stop on an abutment as an aid when making interocclusal record [Figure 6].

Interocclusal Registration Technique with Vacuum Formed Matrix
On the teeth opposing the planned abutments, a 0.20-inch vacuum-formed matrix is made. Prepare the opposing teeth abutments and make the definitive impression in the material of choice. Place the matrix on the opposing dentition and ensure that it clears the opposing occlusion completely. Add autopolymerizing acrylic resin to the surface of the matrix to record a cusp of the preparation in maximum intercuspation or centric occlusion.

Intraoral Resin Coping
Select a preformed polyethylene core former of appropriate size [Figure 7].

- Fill the polyethylene matrix (about one-third) with the resin mixture and place it over the prepared structure.
- Lubricate occlusal surfaces of antagonistic teeth with petroleum jelly. Add small quantities of low shrinkage autopolymerizing acrylic resin to the occlusal surface of the coping and ask the patient to close into maximum intercuspation.
- Keep teeth in contact until complete polymerization. After polymerization, the record is trimmed to remove flash, leaving the impression of the opposing cusp tips intact.
RECENT INTEROCCLUSAL RECORD MATERIALS

T-Scan\[6,16\]
In this system, electrical resistance develops with the applied force. When the patient occludes on the sensor, the particles come together in the force applied areas, diminishing the electrical resistance. The u-shaped sensor foil is 60 microns thick, consists of an X-Y coordinate system with 1500 sensitive receptor points made of conductive ink, and is subject to elastic deformation. When an operator properly uses this technology, mark size, mark color depth, donut-shaped halo contacts, as well as other color and mark appearance characteristics are ignored as force indicators and used only as contact locators. The first occlusal contact that results when the mandible is closed on a correct centric relation axis is known as the centric relation prematurity. This procedure (T-scan) combines bimanual manipulation with the simultaneous recording of the sequence of resultant tooth contacts using a computerized occlusal analysis system. Several researchers have reported that the sensors do not have the same accuracy among themselves and have fewer contacts than conventional methods such as articulating papers. However, it has been shown that the pressure-sensitive film method is not as accurate as the silk ribbon and detecting occlusal contacts. For this reason, it appears that the clinical applicability of the T-scan system is limited. The sensitivity of the T-scan sensors has been reported to decrease or disappear when the sensors are used more than once.

Mizui et al. measured the timing and force of occlusal contacts in both 60 normal subjects and 5 patients with an unspecified craniomandibular disorder (CMD) using the T-scan system. They reported that in the normal subjects the timing and force of occlusal contacts were symmetrical and the center of effort was located in the first molar region. For patients with CMD, the timing and force of occlusal contacts were asymmetric, and the center of effort was not always located in the first molar region, as determined with the T-scan system.

PRESSURE-SENSITIVE FILMS
A newer but essentially similar device has been introduced (Dental Prescale, Fuji Film, Tokyo, Japan). This device also records the location and force of contacts with the force-sensitive film. Hattori et al. evaluated the reliability of this device for occlusal force measurement both on a subject and on casts. They reported the linear relationship between the applied and measured loads. The primary limitation of the contact sensor and the pressure-sensitive film device is that the recording medium is far too thick and results in heavier contacts on the posterior teeth than the anterior teeth. Further, this sensor thickness disturbs the persons finding attempts to close into the intercuspal position. This is because a study on interocclusal thickness discrimination has shown that aluminum foil as thin a 20 µm can give bite-disturbing proprioceptive information to a subject.\[17\]

TYPEWRITER RIBBON
Ziebert and Donegan used typewriter ribbon to mark supracontacts or occlusal interferences in their

Figure 7: Represents resin coping
patients for occlusal adjustments. Interferences were marked with typewriter ribbon and contacts verified with 0.001-inch shim stock. The adjustment procedure basically that of Schuyler following the M. U.D.L. rule for the retruded position, the B.U.L.L. rule for the retruded position, the B.U.L.L rule for the working movement, and the D.U.M.L. rule for protrusion. Non-working interferences were eliminated so as to maintain at least one centric stop on each tooth.

**TRANSPARENT ACETATE SHEET**

It is based on occlusal sketch technique that aimed to provide a simple and reliable means of recording and transferring information about the location of marked occlusal contacts. The authors marked static occlusal contacts of 20 sets of models were recorded in a pseudoclinical situation, by three dentists and in addition by one dentist on two occasions using a schematic representation of the dental arch - the “occlusal sketch.” As per Davies et al., the sketch consists of an acetate sheet on which a schematic representation of the teeth is drawn, including the occlusal surfaces of the posterior teeth, the palatal surfaces of the maxillary anterior teeth, and the labial surfaces of the mandibular anterior teeth. The same authors concluded that this technique demonstrated interoperator and intraoperator reliability in recording occlusal contacts in vitro. The aim of the occlusal sketch technique is to provide a simple and reliable means of recording and transferring information about the location of marked occlusal contacts. It may also be used by the technicians to verify occlusal contacts when articulating casts and fabricating indirect restorations.[17,18]

**OCCLUSION SONOGRAPHY**

The first studies to detect tooth contact by the sounds generated during mouth closure began to appear in the literature in the 1960s, one commercial device was produced in the mid-1980s called “Dental Sound Checker” (Yoshida Dental Trade Distributing Co., Ltd., Tokyo, Japan). The device, based on the principles put forth by Watt, was developed to evaluate occlusal contact sound patterns during closure in an attempt to detect occlusal disturbances. Klifune et al. measured the duration of the occlusal sound in a single subject before and after occlusal adjustment and reported a clear decrease in the duration of the occlusal sound with adjustment. The relationship between graphic records of sounds of occlusion and the types of tooth contact which produced them was investigated by the authors by filming various types of occlusal contacts with a Fastax rotating prism camera at approximately 1000 frames per second the sliding of the teeth over each other was seen on the films as low amplitude vibrations, and the tooth impacts as high amplitude one.[19]

**REFERENCES**


Source of support: Nil; Conflict of interest: None Declared