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Interocclusal recording materials and techniques: A literature review

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Abstract

Precise articulation of casts obtained from the patient is essential for proper diagnosis, treatment planning and successive prosthetic rehabilitation. In addition accurate transfer of maxillomandibular relation to the articulator eliminates the need for occlusal adjustments in final prosthesis, which require additional time and cost. Thus, it is essential to record this relationship with the least possible error to obtain a successful prosthesis. Knowledgeable application of the properties and the various shortcomings of the interocclusal recording mediums and the techniques used to record the relationship is crucial, while selecting ideal material- technique combination.

Keywords: Interocclusal records, interocclusal recording materials, interocclusal recording techniques

Introduction

Interocclusal records are important since these records are used to transfer interarch relationships from the mouth to an articulator [1, 3]. Accurate transfer of maxillomandibular relation to the articulator eliminates the need for occlusal adjustments in final prosthesis, which require additional time and cost [4].

Over the years, various materials and methods have been used to detect occlusal contacts. An ideal occlusal registration material should provide post polymerization dimensional stability, resistance to compression force after setting, accurate recording of incisal and occlusal surfaces of teeth, simple handling, biocompatibility with the tissues involved in the procedure and ease of verification [5, 6]. The criteria for accurate interocclusal recording are, no movement of teeth or displacement of the soft tissues by the recording material and proper seating of recording material on the cast as precisely as on the teeth intraorally. The accuracy of an interocclusal record is influenced not only by the material properties, but also by the recording technique, as well as the anatomic and physiologic characteristics of patient including reliability of the mandibular position influenced by the occlusal contacts, muscular action, or tissue changes within the joints [7].

Indications for Interocclusal Records

Most accurate method of articulation is the occluding of opposing casts by hand that is hand articulation, when there is sufficient number of teeth with good intercuspatation. In such situations, presence of interocclusal records may prevent casts from maximal intercuspatation and resulting in increased vertical dimension [8, 9].

Hence the use of interocclusal records should be limited to the clinical conditions like, (i) the planned restorations involving terminal teeth in the arch or terminal teeth prepared for crowns or fixed partial dentures.

Tripod of three widely spaced contacts between the two casts and good intercuspatation between the teeth are necessary for vertical support and horizontal stability respectively. (ii) Patients seeking prosthodontic treatment who lacks vertical support and horizontal stability as a result of loss of the teeth, worn or flattened occlusal surfaces, and/or the preparation of those teeth.

Types of Interocclusal Record Materials

Materials currently in use can be classified as follows:

1. Developed from impression materials
 - Impression Plaster
 - Alginate impression material.
 - Modelling wax
 - Metalized wax.
 - Zinc oxide eugenol paste.
 - Corrected wax.
 - Elastomers.

2. Others

- Acrylic resin.

Interocclusal Recording Materials

Most of the materials used for interocclusal records are basically impression materials and are modified to give better handling characteristics.

Impression Plaster

The desirable properties of impression plaster as an interocclusal recording material include accuracy, rigidity after setting and dimensional stability with extended storage. In a study, determining the accuracy of different recording materials, plaster showed the least three dimensional changes after 30 min of storage and remained dimensionally stable for more than 24 hours^[10]. However the impression plaster is difficult to handle since the material is fluid and unmanageable prior to setting. The set material is brittle and may fracture on removal from the mouth. With the advent of newer materials, popularity of impression plaster has declined.

Alginate impression material

Ingervall suggested and used a technique, to record the number and location of posterior occlusal tooth contacts, including canines using indexes of alginate (irreversible hydrocolloid) impression material^[11]. The selected subjects rested their backs and heads on a reclined dental chair (approximately 30 degrees to the floor). After spatulation, the impression material was applied to the occlusal surfaces of all lower canines, premolars, and molars and instructed to close the mouth slowly till the teeth contact together with light to moderate pressure, until the impression material was set.

Modelling Wax

Thermoplastic waxes are the foremost frequently used and widely accepted material for interocclusal registration^[12]. This is due to its low cost, simple manipulation and ready availability in clinics^[13]. However, properties like high coefficient of thermal expansion and high resistance to closure will result in inaccuracies during recording. Nonuniform softening of wax during heating results in buildup of internal stresses, which leads to distortion of wax record. Therefore, it has been classified as the most inaccurate material among the interocclusal records studied^[12, 14].

Metalized Wax

The metalized wax wafers contain powdered aluminum particles and retain heat longer for efficient modelling. These are found to be much more accurate than non-metalized wax as the addition of metal particles to the modeling wax make it more conductive which may lead to increase in the accuracy of the record^[2]. Metallized wax produce lower vertical discrepancies than non-metallized wax^[15]. The disadvantage

include incorporation of metal particles makes the wax more brittle.

Zinc Oxide Eugenol Paste

Zinc oxide eugenol (ZOE) pastes are relatively inexpensive and easy to use interocclusal recording material^[12]. The composition of ZOE bite registration paste is similar to the conventional ZOE impression paste with slightly more plasticizer added. This material will accurately and rigidly record occlusal surfaces with high intensity of repeatability^[16]. Fluidity of zinc oxide eugenol before setting, provides nominal interference with mandibular closure during interocclusal recording. However it is difficult to use due to their adherence to teeth and the likelihood of fracture on removal. Lengthy setting time, strong and distinctive taste and burning sensation caused by eugenol make it unacceptable to patients. It is advisable to use a minimum amount of Zinc Oxide eugenol to avoid excess flash as flash around the teeth can interfere with the accurate seating of the casts.¹³

Corrected Wax

In corrected wax, interocclusal record made with wax is corrected with zinc oxide eugenol material. It improves the detailed recording and prevents 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.

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^[17]. 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.

Elastomers

Elastomers are the most dimensionally stable interocclusal record materials, consistently yielded the least error among the materials studied^[18]. 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. Among them, addition silicones and polyether are gaining acceptance among practitioners as well as patients. Addition silicon and Polyether are showing higher dimensional stability and higher resistance to deformation than waxes^[19, 20]. These qualities are attributed to the fact that, addition silicone and polyether set by addition polymerization reaction and open chain reaction respectively. Therefore, no by-products and no loss of volatiles will cause discrepancies in the recorded material. However, the major disadvantage is the spring action found in these materials which may cause inaccuracies during mounting of the casts. The spring action found in these materials cause 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.

Techniques

Dawson's technique

Most common technique for recording maxillomandibular

relationship in centric relation is thermoplastic bite wafer made from base plate wax. Wax is softened and placed against the maxillary arch to indent it. The mandible is manipulated bilaterally to centric relation and patient closes into the wax. Removal of record can be accomplished when the wax gets adequately cooled. After verification of the record, the mild indentations within the wax are "washed" with a more accurate material (usually ZOE paste) and therefore the recording is repeated. The interocclusal record obtained represents a stable laminate consisting of the thermoplastic wafer and a wash of ZOE paste or an elastomer [21, 22].

Anterior Stop Technique

The anterior stop centric relation record is accomplished with an anterior deprogramming appliance such as lucia jig that is fabricated before the interocclusal record, or leaf gauge composed of several 0.1 mm thick plastic strips. This deprograms the influence of the posterior dentition by creating a platform that the incisal edge of the mandibular central incisor contacts. This provides posterior space for the interocclusal material and the carrier. This result in the patient "forgetting" established protective reflexes that are reinforced each time the teeth come together, making mandibular hinge movements easier to reproduce. The resulting anterior stop acts as a fulcrum, allowing the directional force provided by the elevator muscles to seat the condyles in centric relation within the fossae. The stop should be thin enough in order that the primary 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 polymerize. This technique can be coupled with the bilateral mandibular manipulation technique [23, 24].

Enamel Island (cone) Method

This method allows an accurate interocclusal recording when the most distal tooth is an abutment of FPD. The method preserves conical stops in the enamel of the abutment tooth, to maintain the vertical dimension of occlusion and to act as the third point of reference for a stable occlusal relationship when occluding definitive casts. Materials generally used are polyether, silicone or acrylic resin [25, 26].

Stabilized Baseplate Technique

This technique allows to record centric and eccentric jaw registrations that are stable intraorally and can also be transferred accurately to the working model. In this technique relief over the occlusal surfaces of uncut dies is created using silicone putty impression material and the edentulous ridges are covered using tinfoil. A baseplate using selfcure resin is made in the shape of an occlusal rim extending 1-2 mm over the facial surfaces of the prepared teeth. The baseplate is trimmed to attain a passive fit and relined in the edentulous areas using polyether impression material. Part covering the prepared teeth is relined intraorally with an interocclusal registration paste [27].

Interocclusal Registration For Implant Supported Prosthesis

Haralampos P. Petridis suggested a method to record stable interocclusal records for implant patients with posterior edentulism [28]. In this technique, castable plastic burnout abutments are connected to the implants after making definitive impression of the implants. The abutments should

permit rotation to connect multiple implants. Abutment height is adjusted to the available interocclusal distance and connected together intraorally with a low-shrinkage autopolymerizing acrylic resin to create a platform for orienting the interocclusal registration material. Interocclusal registration can be made with a suitable material such as vinyl polysiloxane.

Discussion

Fabrication of a prosthetic restoration involves series of procedures and it is important to understand that, incorporation of error can occur at any stage. However error of significant value occurs while taking the registration records and transferring them to the articulator. These errors can be minimized by proper selection of the materials and technique used. The determining factor for selection of interocclusal record material and technique is the existing clinical condition. In a clinical condition where in there is good intercuspation between the existing teeth, no record may be needed whereas if there is poor intercuspation, a full arch or segmental record may be made using elastomeric materials or a segmental record may be made only over the prepared tooth/teeth using rigid materials like wax, plaster, resin or paste [2]. As well, if planning occlusal rehabilitation using confirmative or reorganized approach, requirements for interocclusal records is different for both. In confirmative cases only the occlusal surfaces of the prepared teeth require to be recorded for the registration unless records of excursive movements are required. In this way, the clinician can be sure that no interpositional material is obstructing complete closure. In recording occlusal surfaces in these cases self-curing acrylic resin or polyvinyl siloxane pastes are useful. A full arch wax record is not acceptable since there is no certainty that full occlusal contact has been made of teeth not involved in the restoration.

When changes to the existing occlusal scheme are planned, that is, nonconformative, the prescription to the technician must provide details not only of the surface of the teeth but the proposed vertical and horizontal relationships along with details of the maxillary plane, condylar movements and incisal guidance [20].

Incomplete seating of the cast into the interocclusal record will incorporate discrepancies while mounting casts in centric relation. Dimensional changes in the material and inaccuracy of the cast will lead to incomplete seating. Aris-petros tripodakis *et al.* have suggested a technique, that can be applied to overcome these inaccuracies to some extent [29]. They suggested that the record (polyether) should be incorporated in the impression material itself and then used for the construction of the opposing cast.

This would eliminate the need for transferring by repositioning the record on the model. Although the errors can be minimized by careful technique and control of materials, it is a known fact that they cannot be completely eliminated because of the inherent properties of the various materials that may be employed in the procedure. Investigations have shown that most of the materials continue to undergo dimensional changes even after the setting time indicated by the respective manufacturers. Besides, the possibility of human error always exists [19]. Hence recording interocclusal relationship is always an exacting task. Hence it should not be done in a hurry by the clinician. On the other hand, patient must also be co-operative. Once the record is obtained, it must be carefully handled by the laboratory personnel while using it to mount the models on the articulator.

Conclusion

Diagnosis, Treatment planning and fabrication of prosthetic restoration require precise articulation of casts obtained from the patient in approximately the same relationship to the temporomandibular joint as it exists in the patient. The ideal material-technique combination for making interocclusal records would minimize the error that occurs while taking the registration records and transferring them to the articulator. Hence the clinician should be able to select ideal-material technique combination by knowledgeable application of the properties and the various shortcomings of the interocclusal recording mediums and the technique used to record the relationship. This 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.

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