Review Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2021;11:3:150-158.

Interocclusal Records in Fixed Prosthodontics: A Review on Clinical Techniques

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ABSTRACT

Background: A successful fixed prosthesis must be in perfect harmony with the functional and anatomical structures in the oral cavity. The relationship of maxilla and mandible is not just simple opening and closing movement, but it is a complex three-dimensional relation. Recording the similar relationship extra orally for fabrication of prosthesis requires meticulous knowledge of interocclusal recording material and clinical techniques. Error in making the record may occur in any direction- vertical, anteroposterior, or mediolateral. Also, in instances where the vertical relationship is lost because of widely spaced opposing contacts and lacking tripod contact requires an interocclusal record that restores the vertical support to avert incorrect mounting. Thus, it is essential to record this relationship with the least possible error to obtain a successful prosthesis. This article aims in understanding the selection of various techniques for making interocclusal records for a variety of clinical situations.

Keywords: Interocclusal record material and techniques, tripod relationship, occlusal relationship.

INTRODUCTION

The *Glossary of Prosthodontic 9* defines an interocclusal record as "a registration of the positional relationship of the opposing teeth or arches; a record of the positional relationship of the teeth or jaws to each other"[1]. Interocclusal records are used to transfer interarch relationships from the mouth to an articulator.

A tripod of vertical support and horizontal stability is mandatory for holding maxillary and mandibular casts together in a stable and reproducible manner. Vertical support prevents wobbling of casts, and horizontal stability prohibits horizontal rotation and translation between the casts during the mounting procedure[3]. For examination of patients occlusion for diagnostic or planning purposes and fabrication of indirect restorations at a desired occlusal scheme, an accurate and sturdy interocclusal record is essential. The incorrect record leads to the inaccurate mounting of working models followed by an error in the fabrication of the final prosthesis. This leads to significant chair-side adjustments or necessitates the need for a restoration to be re-made. This can be a challenging scenario for the clinician and unnecessary discomfort for the patient also.

When the aim of prosthodontic treatment is to conserve a patient's pre-rehabilitation intercuspation and vertical dimensions, the working casts must be articulated in a way that perpetuates the same tooth to tooth relationship as it was

Received: Jan. 24, 2021**: Accepted**: Mar. 1, 2021
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pISSN 2278-0076
eISSN 2321-9270

pretreatment. Maximum intercuspation position (MIP) helps in maintaining existing occlusion. MIP/Centric occlusion is defined as "the complete intercuspation of the opposing teeth independent of condylar position, sometimes referred to as the best fit of the teeth regardless of the condylar position[1]. The majority of cases falls in MIP category[2]. But when the patient requires extensive treatment, when tripod contact is lost, or vertical dimension needs to be altered. The goal of the interocclusal record is to provide stability and support to the casts for articulation in centric relation.

This article aims in understanding the selection of various techniques for making interocclusal records for a variety of clinical situations.

Types of interocclusal records

Interocclusal records used to mount casts in MIP can be separated into two categories:

(1) records made when a tripod of vertical support is available from the remaining tooth-to-tooth contacts (an "existing tripod" interocclusal record) and (2) records made when a tripod of vertical support is not available from the remaining tooth-to-tooth contacts (a "created tripod" interocclusal record) [3].

On the basis of the type of relation recorded, the interocclusal record can be categorized as:

(1) Retruded contact position(RCP) or Centric relation

(2) Maximum intercuspal position(MIP) or centric occlusion

(3) Eccentric records- Lateral and protrusive records.

The type of interocclusal record made also describes the use of articulator (Table – 1) for the fabrication of fixed dental prosthesis[4].

Table 1: Indications of interocclusal record and type of articulator.

Type of restoration	Interocclusal record	Articulator
Single anterior or posterior unit	None, MIP	Not usually necessary/simple hinge articulator
Last standing molar	MIP	Simple hinge
Multiple anterior units	MIP and protrusive record	Semiadjustable with customized incisal guidance
Multiple posteriors in one arch	MIP and protrusive/lateral record	Mean value or semiadjustable articulator with facebow transfer
Multiple posteriors in both arches	RCP and protrusive/lateral record	Semiadjustable articulator with facebow transfer or fully adjustable
MIP- maximum intercuspal position, RCP- retruded contact position		

INTEROCCLUSAL RECORD MATERIALS

An ideal interocclusal record should be dimensionally stable, easy to manipulate, should not displace surrounding soft tissues, should be rigid, resilient and verifiable after setting[4]. There are various interocclusal record materials, as shown in Fig-1, along with their advantages and disadvantages[5].

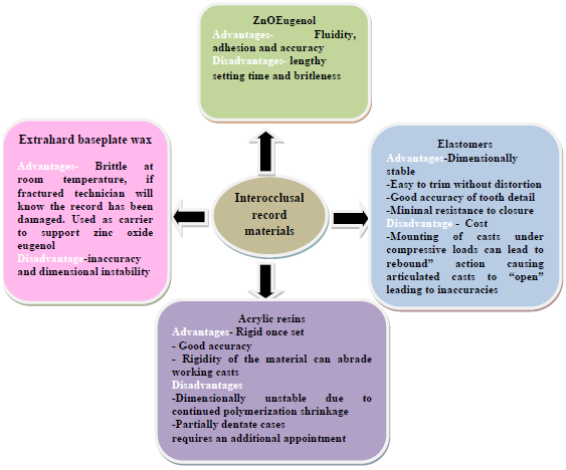

Fig 1: Advantages and disadvantages of inter-occlusal record materials.

CLINICAL TECHNIQUES TO MAKE INTEROCCLUSAL RECORDS

1. **Single unit Restoration:**

- In the presence of good intercuspation and stable occlusal contacts, hand-articulating the opposing casts without any intervening material is a most accurate method. Use of

articulating paper and shimstock foil should be done to mark the occlusal contacts intraorally and on working casts. The markings should be reconfirmed in the laboratory and prior to restoration[6].

- If an interocclusal record is required, polyvinylsiloxane, wax or extra-hard baseplate should be used on prepared teeth and opposing teeth of the same arch.

Wax bite record technique- Extra-hard baseplate wax is softened and folded over double thickness. Wax is placed on the maxillary arch, and the patient is asked to close in maximum intercuspation position. The wax is then inspected for indentation of opposing teeth and distortion. For recording finer details, the indentations can be relined using zinc oxide eugenol paste in the same position[Fig- 2]. Excess flash material should be scrapped before sending it to the laboratory. The clinician must re-examine the record for the flow of material on adjacent teeth, as that induces inaccuracies and record false occlusal relationship [4,6].

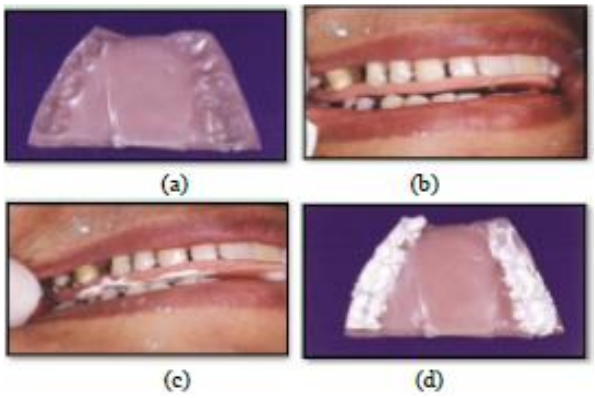

Fig 2: (a)Softened interocclusal wax record (b) Buccal cusps visible on record (c) Record relined (d) Rigid, stable, accurate record

- In cases of occlusal wear, when horizontal stability of casts cannot be achieved, but vertical support is stable, then polyvinylsiloxane syringe material should be used to record the interocclusal relationship(Fig-3). The material provides precise surface detail of the surfaces and dimensionally very stable. The record helps in orienting the cast in proper occlusion[7].

Fig 3: Interocclusal record made using polyvinylsiloxane syringe material.

- In scenarios where the last tooth in the arch is prepared, but stable tripod contact is present, then the above-mentioned methods can be used. Apart from them, acrylic resin coping can be made to establish a relation between the prepared tooth and opposing dentition (Fig-4). A self-cure acrylic resin block can be used to record interocclusal space, but polymerization shrinkage can cause errors and may not seat properly over the casts. Construction of acrylic coping can be done directly intraorally or indirectly on the master cast and then relined intraorally for the accurate record. The coping is then transferred to the die to facilitate articulation of casts [8].

Fig 4: Acrylic coping for maintaining tripod relation.

2. Prosthesis for terminal abutment :

Island technique- When distal abutment, which is responsible for maintaining vertical stop of one side of the arch to be prepared, it becomes difficult to maintain the vertical occlusal dimensions and re-adapting patients mandible in true centric relation[Fig-5(a)].

Technique:

- In such scenarios, the firstly centric relation of the abutment or first contact point of the

abutment needs to be identified. Failure in identification of this contact might cause confusion for the clinician while preparation and might lead to overzealous preparation and unnecessary loss of tooth structure to achieve sufficient occlusal clearance[9].

- Before preparing the tooth, the centric stop should be marked using articulating paper, and then conventional preparation is undertaken. However, an island/pillar where the centric stop is marked should be left unprepared to maintain the relation [10][Fig-5(b)].
- A temporary self-cure crown(Fig- 5(c)) is fabricated of height and occlusion of final restoration using direct or indirect temporization fabrication technique.
- The temporary crown is placed on a partially prepared tooth, and the "island" is reduced until it merges with the occlusal margin of the temporary crown[7](Fig- 5(d)).
- The final impression is made, and casts are articulated according to the interocclusal record made using a temporary crown for establishing tripod contact.
- The final restoration is fabricated.

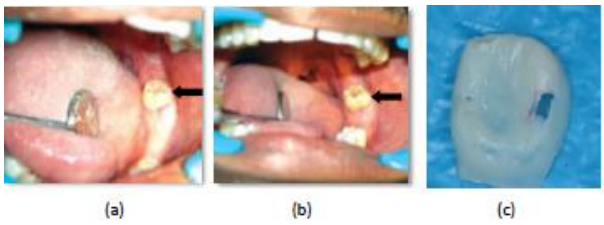

Fig 5: (a) Shows identified Centric stop (b) Preparation of terminal abutment with centric stop (c) temporary crown with perforation for enamel island.

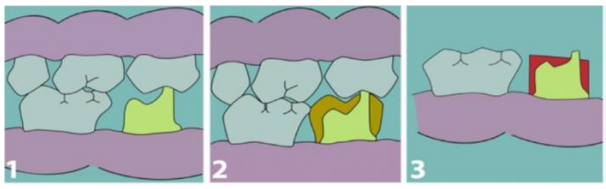

Fig 5: (d) A depiction of the 'Island Technique' preparation and subsequent coping within the laboratory(15).

1. **Prosthesis with missing opposing teeth:**

When teeth in the opposing arch are missing, to establish tripod configuration, the interocclusal record needs to be stabilized by the edentulous alveolar ridge. An acrylic denture base with occlusal rims is to be fabricated. And indention of opposing cusps tips needs to be recorded in wax rims before starting tooth preparation. This can be relined using Zinc oxide eugenol to record the interocclusal space (Fig-6(a)). If denture base and wax are not fabricated, then putty consistency polyvinylsiloxane material (Fig-6(b)) or extra- hard baseplate wax can be used for gaining support from alveolar ridge [11].

Fig 6: (a)Acrylic base plate with wax rims interocclusal record (b) Indentations recorded in PVS putty consistency material.

1. **Prosthesis for Full mouth rehabilitation cases :**

In severely worn down teeth or multiple missing teeth, no occlusal or vertical stop remains on existing tooth surfaces. In this scenario capturing condylar position at desired vertical dimension becomes very crucial. Both centric and eccentric interocclusal records are required to be made to obtain horizontal and lateral condylar inclination[12] .

Dawson [13] introduced a bimanual manipulation technique to guide mandible in centric relation (CR). After obtaining repeated and verifiable centric relation, the following methods can be followed for bite registration.

a) Wax bite record- Hard, brittle baseplate wax or bite wafers are used for this technique. The mandible is manipulated to CR, and softened wax is placed against the upper arch to indent it, and the patient closes into the wax. While the closing patient may protrude, the jaw and upward loading compressions are needed to be applied on condyles for manipulation of the mandible in centric relation.

Bimanual manipulation technique and chin point guidance method is described as reliable and reproducible methods for positioning of the condyle in CR. Any impingement of wax into soft tissues should be removed.

b) Anterior stop/ Anterior deprogramming device technique- The anterior deprogrammer creates a small contact point for the incisors to meet and disengages all of the posterior teeth. When the posterior teeth are not allowed to contact, the hyper-functioning lateral pterygoid muscles relax, and the elevator muscles activity will decrease, which allows the TMJ to sit in centric relation[23]. Lucia jig, Pankey jig, and leaf gauge are used as an anterior deprogramming device. These jigs are fabricated using self-cure acrylic resin, impression compound and direct composite resin on maxillary incisors to provide anterior stop when first tooth contacts in the posterior region. So it must be thin and allows space for bite registration material in the posterior region. A firm setting bite registration material is injected on the occlusal surface of teeth and allowed to set(Fig-6). The complete setup is then transferred to the articulator[5].

Fig 6: A centric relation bite record performed with the use of a leaf gauge and Lucia jig.

c) Sectional provisionalisation method- This technique is followed when a complete arch is to be prepared and temporized. Provisional restorations are used for maintaining the vertical dimension on which occlusion is to be restored. Provisional restorations are to be fabricated in three sections, one anterior and two posterior sections[12].

Steps-

- After completing complete tooth preparations and achieving adequate occlusal and incisal clearance, as per the diagnostic wax-up, provisional restorations are fabricated by either direct or indirect technique in three sections.
- Interocclusal record is made with the help of provisional restorations.
- Only anterior provisional restoration is placed, and the patient's mandible is manipulated in centric relation and rehearsed again and again till the patient bites in the same position repeatedly. Anterior provisionals act as an anterior deprogramming device.
- Bite registration material is injected into the posterior region and allowed to set. After complete setting, excess material is trimmed so that no deflective contacts are present while verifying the record. (Fig-7)

Fig 7: Posterior interocclusal record making with anterior provisional restoration.

- The anterior provisional is now removed, and the record is verified without the provisional in place.
- Posterior provisional restorations are placed, and small amount of material is placed on lower anteriors and patient is asked to close mouth. (Fig-8).

Fig 8: Anterior interocclusal record making with posterior provisional restoration

- The posterior provisions are then removed, and all the three segments are verified intraorally (Fig-9).

Fig 9: Verifying both segments of interocclusal record intraorally.

d) Vaccuform technique- In some situations, because of multiple missing teeth or short clinical crowns, splinted provisional restoration needs to be fabricated. The above technique cannot work in such cases. The interocclusal record can be made using vaccuform technique. [12]

Steps

- Tooth preparations of the complete arch are done with the guidance of diagnostic wax-up, and temporary restorations are cemented on raised vertical dimension at which occlusion is to be restored.
- The patient is kept on temporary restorations for a period of 2-4 weeks for complete adaptation of temporomandibular joint on raised VD and centric position.
- When the patient reports comfort, after raising the vertical dimensions and adapting condylar position, an impression of maxillary arch is taken with accepted provisional restorations and cast is poured.
- A complete palate vaccuform shim is fabricated over a provisional restoration cast (Fig-10) for making an interocclusal record.

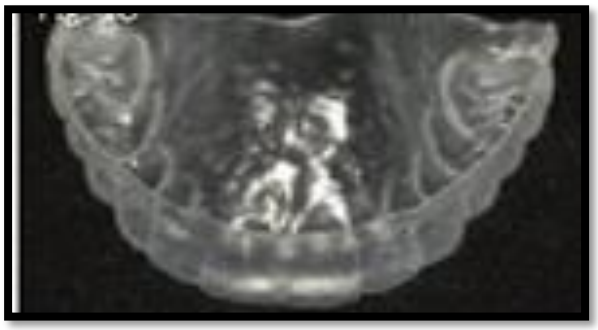

Fig 10: Vaccuform shim fabricated over provisional restoration cast.

- The vaccuform is trimmed from the buccal and labial surface for the elimination of undercuts, leaving palate as a stop, and is tried in the mouth. This try-in serves to verify the interdigitation and indexing to the opposing arch (Fig. 11)

- A polyvinyl silicone bite registration material is placed inside the vaccuform and seated in the mouth. The patient is asked to close till interdigitation with opposing teeth is achieved. Bite registration material is not placed in the palatal portion of the shim so that a verified seating to the palate is visible (Fig-12).

Fig 11: Verification of interdigitation of vaccuform shim and indexing to the opposing arch 12. Inject bite registration material and occluding in CR

- When the material is set, additional material is injected on the occlusal surface of opposing teeth and close gently until teeth interdigitate again. (Fig-13)

- The excess material from the record is trimmed and replaced in the mouth for verification (Fig-14).

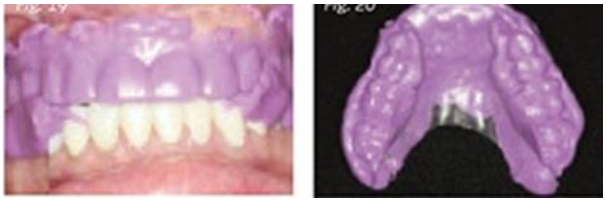

Fig 13 and 14: Additional material injected on occlusal surface of opposing teeth. 14. Final interocclusal record made in vaccuform shim

3. **Implant supported prosthesis-** for making jaw relation in implant restorations the aim is to establish stable denture base attached to implant head which can be achieved by following:

a. **Single unit restoration-** interocclusal record can be made with bite registration paste similar to fixed partial denture.
b. **Large edentulous span-** An occlusal rim needs to be made, and JR should be recorded as for RPD.
c. **Full arch removable restoration-** JR is to be done as for complete dentures using implant retained record bases (Fig-15).

Fig 15: Implant screw retained occlusal rims and record bases.

d. Full arch fixed segmental prosthesis- During framework try-in, new centric relation should be recorded with pattern resin. For stabilization of denture bases, healing abutments, gold cylinders, healing caps are required. Petridis HP and Savabi O [13, 14] described a technique for making interocclusal relationship using customized UCLA abutments.

Procedure:

- After making a definitive impression of implants, Customized castable abutments or titanium abutments are connected to implants.
- According to interocclusal distance, the height of the abutment is adjusted.
- Abutments are connected with pattern resin intraorally (Fig- 16 a).
- This creates a platform to act as a carrier for bite registration material.
- Interocclusal record is made using PVS material (Fig-16 b)
- Record is transferred to the laboratory, and castable abutments can be used for the fabrication of final restorations.

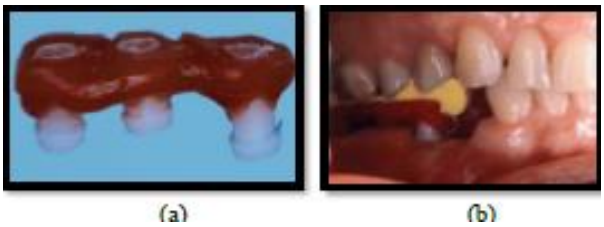

Fig 16: (a) Pattern resing connecting the abutments (b) Interocclusal record made using PVS material over pattern resin base.

e. **For complete arch fixed prosthesis-** Acc. to Savabi, O., Yosefimoghadam, A., & Nejatidanesh, F.[24] procedure to be followed

- Impression copings are attached to implants after removing the cover screw, and a definitive impression is made.
- The position of implants in the master cast is verified using a verification jig.
- Plastic sprues are attached to implant analogues and splinted with each other using pattern resin. This acts as a record base for making jaw relation(Fig- 17.1).
- Peripheries are smoothened and Occlusal rims are built over the record base(Fig-17.2& 17.3).
- The record base and occlusal rims are then placed on implants intraorally and vertical relations are verified.
- Polyvinyl siloxane bite registration material is injected on the occlusal surface of rims and mandible is guided to close in centric relation and material is allowed to polymerise (Fig-17.4).
- The recorded relation is then articulated on semi-adjustable articulator after facebow transfer and teeth arrangement or framework fabrication is done.

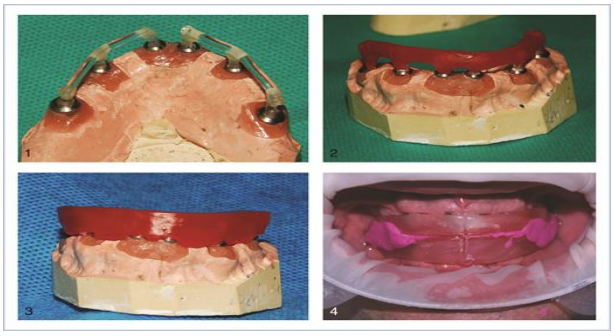

Fig 17.1: Plastic sprues on top of implant analogues. 17.2 Connected sprues are reinforced by auto polymerizing resin. 17.3 Record base an occlusion rim. 17.4 Centric relation record.

Digital interocclusal records:

The various intraoral scanner has been introduced which allows recording of tooth preparation and occlusal relationship coupled with CAD/CAM units for designing and milling of the final restoration. Popular intraoral digital scanning systems include CEREC® (Dentsply Sirona, USA), Lava TM Chairside Oral Scanner system (3M ESPE, USA), iTero® (Align Technology, USA) and TRIOS® (3Shape, Denmark). These scanners differ in technology, design, file format, the requirement of powder spray and systems available with milling units. Intraoral scanners have been proved to show excellent accuracy in records for single restorations, short-span bridges and implant bodies. After scanning of arches, the immediate interocclusal record can be made by scanning the buccal surfaces, while the maxillary and mandibular arch are in occlusion.

Whereas in long-span edentulousness or completely edentulous arches and implant-supported prosthesis, scannable bite registration materials like Virtual CAD bite registration material(polyvinylsiloxane), O-bite scan can be used for recording occlusal relationship and scanned extra orally using laboratory scanners. The interocclusal record is made intraorally or on master models using polyvinylsiloxane material. The record is then scanned, and a transilluminated file of the record is captured digitally, which is merged with the virtual casts and further digital workflow is followed for designing and fabrication of prosthesis(Fig-18)[22].

Fig 18: (a)Interocclusal impression of master models in maximum intercuspal position. (b)Transilluminated interocclusal record.

CONCLUSION

Fabrication of a prosthesis mediates numerous steps, and errors can occur at any level and leading to discrepancies in the final restoration. Error in jaw relation recording crop up while transferring the record from the patient's mouth to the articulator. Careful technique and control of materials can minimize errors. Due to the inherent properties of various materials used in the procedure, these errors cannot be completely eliminated. With appropriate interocclusal record material and selection of technique, we can give better and precise restorations with minimal adjustments.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. The Academy of ProsthodonticsFoundation. The Glossary of Prosthodontics Terms J Prosthet Dent.Ninth Edition.

2. Squier RS. Jaw relation records for fixed prosthodontics. Dent Clin N Am. 2004;48:471-486.

3. Freilich MA, Altieri JV, Wahle JJ. Principles for selecting interocclusal records for the articulation of dentate and partially dentate casts. J Prosthet Dent 1992;68:361–7.

4. McCullock A J. Making occlusion work: I. Terminology, occlusal assessment and recording. Dent Update. 2003;30:150-157.

5. B. Deepthi, Rakshagan V, Jain A.R . Recent interocclusal record material for prosthetic rehabilitation - A literature review. Drug Invention Today. 2018;10:10:2004-09

6. Mehta S, Banerji S. The application of occlusion in clinical practice Part2: the taking of occlusal records. Dent Update. 2019;46:30-41

7. Wise MD. Conformative techniques, In: Wise MD, Laurie A (ed.) Failure in the restored dentition: management and treatment. London: Quintessence Publishing;1995:597-599.

8. Warren K, Capp N. A review of principles and techniques for making interocclusal records for mounting working casts. Int J Proshodont. 1998;3:341-348.

9. Ali K, Addison T. Managing the last tooth in the arch syndrome and restoring retruded contact position. Dent Update. 2019; 46:438-449.

10. E. MangalaDeivanai et al.Comparative evaluation of the accuracy of two methods of occlusal registration involving terminal abutments – an invivo study. Pakistan oral & dental journal:2013;33:1

11. ThanabalanN,Amin K. , Butt K, Bourne G.Interocclusal recordsin fixed prosthodontics. Prim Dent J. 2019;8(3):40-47.

12. Chasolen H. Two techniques to make a bite record for full-arch case.Dentaltown archives:April2013

13. Dawson PE. Functional Occlusion: From TMJ to Smile Design. St. Louis: Mosby (Elsevier); 2007. p. 93-7.

14. Petridis HP. Stable interocclusal records for implant patients with posterior edentulism. J Prosthet Dent 2004;92:503.

15. Wise MD, Laurie A. Failure in the Restored Dentition: Management and Treatment. London: Quintessence, 1996

16. Prasad D.K, Prasad B R, Prasad A, Mehra D. Interocclusal records in prosthodontic rehabilitations - materials and techniques- a literature review. NUJHS ;2012:2-3

17. Abrol K, Abrol S. T- Scan – The dental advisor.International Journal of Applied Dental Sciences 2019; 5(2): 25-27

18. Pyakurel U, Long H, Jian F, Sun J, Zhu Y, Jha H. Mechanism, accuracy and application of T-Scan System in dentistry-A review. Journal of Nepal Dental Association.June 2013

19. Hirano S, Okuma K, Hayakawa I. In vitro study on accuracy and repeatability of the T Scan II system. Kokubyo Gakkai Zasshi. 2002 Sep;69(3):194-201.

20. Koos B, Godt A, Schille C, Goz G. Precision of an instrumentation-based method of analyzing occlusion and its resulting distribution of forces in the dental arch; J Orafac Orthop 2010; 71:403-10.

21. Reza Moini M, Neff PA. Reproducibility of occlusal contacts utilizing a computerized instrument. Quintessence Int 1991;22:357-60.

22. Edher F, Hannam A.G, Tobias D.L, Wyatt C. C.L, .The accuracy of virtual interocclusal registration during intraoral scanning. J Prosthet Dent 2018;120:904-12

23. Jayne D .A Deprogrammer for Occlusal Analysis and Simplified Accurate Case Mounting. The journal of cosmetic dentistry 21(4):96-102,2006.

24. Savabi, O., Yosefimoghadam, A., & Nejatidanesh, F. (2009). A Method for Making the Implant-Supported Record Bases. Journal of Oral Implantology, 35(6), 300–302. doi:10.1563/aaid-joi-d-09-00019r1.1