

Occlusal Analysis In Complete Dentures: A Review Article

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Abstract

In dental field it is necessary to recognize occlusion and errors produced during recording it. Due to the complex nature of the human occlusal system, difficulty level increases to analyze the problems arising from occlusal origins. Previously many occlusion analysing materials have been used. Therefore the correct occlusion plays an important role for dentist and technician. The present review elaborates the occlusal pressure patterns of complete denture wearers to evaluate progress of occlusal adjustment of dentures

Key words: Complete denture, Occlusal pressure pattern, Occlusal adjustment

Introduction

The absence of deflective occlusal contacts between opposing maxillary and mandibular teeth during jaw movement is related directly to a reasonable philosophy of complete & partial denture occlusion, which means that by removing the presence of deflective occlusal contacts, equilibrium of denture occlusion is improved, resulting in stabilization of dentures.¹

To establish the philosophy of occlusion, the simultaneous contacts of

occlusal surfaces on the maxillary and mandibular dentures without premature contacts while occluding is essential. Dental articulators are used to perform occlusal adjustment of denture teeth. However, final assessment of denture occlusion should be performed in the oral cavity.²

- **Importance Of Occlusal Analysis In Complete Denture:**³

The exact orientation of the occlusal plane plays a vital role in optimal esthetic achievement. In the natural smile, the incisal tips follow the curve of the lower

lip, this is an expression of a correctly oriented occlusal plane. If the occlusal plane hangs posteriorly, the lip-line viewed from the front will look straight and contribute more than any other factor to the so-called 'denture look'. With the occlusal plane correctly oriented, however, the natural anterior curve will be reached almost automatically and contribute a proper sense of perspective to the dental composition.

The plane of occlusion, forms an essential part of the concept of mechanically balanced articulation. The position of occlusal plane in denture wearers should be as close as possible to the plane, which was previously accommodated by the natural teeth. Such position of the occlusal plane provides normal function of the tongue and cheek muscles, thus enhancing the denture stability. It is believed that teeth oriented on an occlusal plane in harmony with the individuals physiognomy is responsible, in part, all conditions being equal, for stable, retentive full dentures.

Where the occlusal plane is elevated, the tongue cannot rest on the lingual cusps of the lower denture and prevent its displacement. Also it drives the tongue into a new position that is higher than its normal position. This higher position of the tongue causes the floor of the mouth to raise and create undue pressure on the border of the lingual flange and results in partial loss of border seal. There is also tendency for accumulation of food in the buccal and lingual sulci. An occlusal plane that is too low causes tongue and cheek biting.⁴

Methods For Occlusal Analysis In Complete Denture:

There are two methods:

- 1) Qualitative methods
- 2) Quantitative methods

Qualitative methods:

To examine occlusal contacts intraorally, bite registration materials such as articulating paper, wax, and silicone etc are often used . The techniques using these materials are performed simply and quickly, while it is difficult to determine the presence

and the location of the premature occlusal contacts.^{5,6}

Quantitative method:

To determine the presence of the premature occlusal contacts objectively, it is necessary to evaluate the occlusal contact sequence. Several studies have been reported on occlusal contacts recorded by using a computer-based measuring device which is available to record the amount of occlusal pressure sequence. One report shows that the equilibrium of occlusal contact of complete dentures can be evaluated by using a position of the center of gravity of occlusal loads.

With the unique function of this device it displays numerical values of the occlusal contact pressure continuously during occlusal contact sequence. In literature it is found that these numerical values for complete denture wearers records while occluding allowing the quantitative evaluation of the progress of the occlusal adjustment. Recordings of occlusal pressure patterns sequence, which

are independent of the occlusal scheme, have possibility to be used for the assessment of occlusal contact conditions of the complete dentures.²

Recently, a computer-based occlusal pressure measuring device (T-SCAN system Ver5.0, Nitta, Japan) was used to record occlusal contact pressure sequence with a pressure sensing sheet (T ScanII, Tekscan, USA). The spatial distribution of the measured pressure was displayed after being digitized with the software program at 127Hz sampling rate which was the maximum capable speed of this system, providing the occlusal pressure patterns. Subjects were seated upright in dental chairs, and then an operator inserted the recording handle with a sensor sheet. Subjects were instructed to tap the sheet in place between maxillary and mandibular dentures with maximum effort.²

The T-Scan III (Version 7, Tekscan, Inc. S. Boston, MA, USA) center of force (COF) trajectory and summation icon, aids the clinician in improving the orientation of the occlusal force summation

during a complete denture insertion force-finishing occlusal adjustment procedure.

The occlusal forces (of a removable prosthesis) can be observed within the T-Scan III desktop (Figure-1), which is organized into four panes; the 3-dimensional column view (upper left pane; force levels illustrated by color-coding and column height), the 2-dimensional contour view (upper right pane; force levels illustrated by color-coding and occlusal surface location) that houses the COF trajectory, its' red and white diamond-shaped icon, and the white/gray COF ellipse, (the ellipse is a "target" that assesses overall prosthesis force balance), the force versus time graph (lower right pane) and the zoom graph (lower left pane).

Each of these panes allows the clinician to observe the recorded occlusal force and time-sequence data that guides the occlusal adjustments accomplished during the insertion of a complete denture.

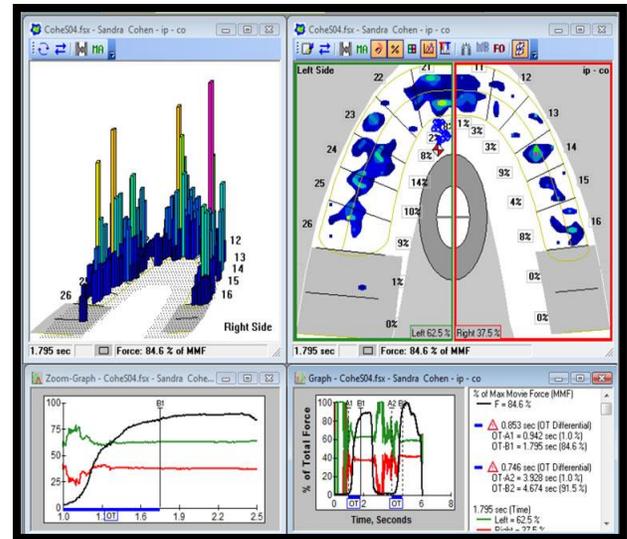


Figure :1 Occlusal force recorded

The black curving line is the total force line, which raises, crests, and drops as the patient occludes, holds their teeth together, and then opens their occluded teeth. The red (right arch half) and green (left arch-half) lines illustrate the changing occlusal force percentages of each arch half, as they evolve within the recorded movie. Once the patient has reached complete occlusal intercuspation, the red and green lines will become parallel to each other (in bite 1 at 1.795 s; at B1). The degree of red, green horizontal line separation indicates the degree of

prosthesis right to left force percentage imbalance. Figure: 2

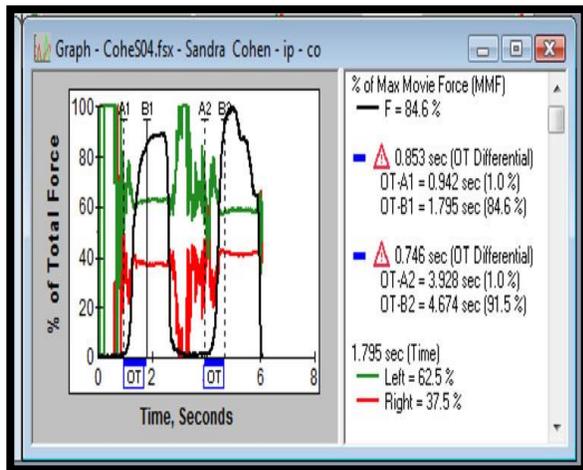


Figure: 2 red and green horizontal lines

• **Full Closure Movie Recording Technique**:⁴

Insert the T-Scan sensor intraorally by resting the T-Scan sensor support within the facial central incisor embrasure of the maxillary denture's central incisor teeth. Then activate the recording by depressing the Record Button on the top of the T-Scan III recording handle (Figure - 3a, b). The patient is then asked to firmly intercuspate into the sensor using their complete denture occlusion, and to firmly hold their teeth together for 1–3 s once maximum intercuspation is reached. To

capture 2 intercuspations, the patient opens after the first intercuspation, and then re-intercuspatates into the recording sensor firmly, once again.

This type of recording illustrates the force details of the occlusal contact time-sequence from 1st tooth contact through to complete intercuspation, while simultaneously describing the history of the right to left arch half force imbalance of the contact closure sequence.

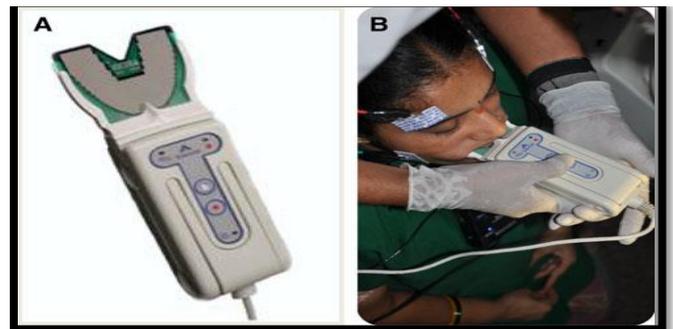


Figure - 3 a, b – T scan III recording handle

- **Types of complete denture occlusion:**
 - 1) Bilateral balance occlusion.
 - 2) Neutro centric occlusion (monoplane occlusion).
 - 3) Lingualized occlusion.

The importance of balance occlusion in complete denture:

- 1) It avoids displacement of denture during functional movements.
- 2) It assist in earlier repositioning of denture which become displaced during mastication
- 3) During swallowing of saliva, teeth come in contact and this contact demand equal pressure with satisfactory position of the cusp in the opposing fossae. If there is no balanced occlusion the cusp will hit in the opposing fossa result move of the denture base which lead to unstable denture also lead to trauma to the supporting tissue and discomfortable and then resorbtion.

- **Selective Grinding For Occlusal**

Adjustment:

Selective grinding is defined as the, “any change in the occlusion intended to alter the occlusal surfaces of the teeth or restorations to change their form.” - GPT -9.

Goals Of Selective Grinding:

This procedure should accomplish the following requirements:

1. should Develop a stable intercuspal position in CO, so that all possible posterior teeth centric cusp tips contact opposing flat surfaces evenly and simultaneously with the occlusal forces which directes along the long axis of teeth.
2. Develop a plane of occlusion with adequate inter-arch space for prostheses replacing missing teeth.
3. it should Provide laterotrusive contacts to disocclude the posterior teeth when the mandible moves laterally.

Selective grinding involves the correction of occlusal equilibrium in a complete denture prosthesis. Occlusal errors are rectified by selectively grinding specific tooth surfaces, to preserve the desired form of the tooth and occlusion developed prior to processing.⁷

- **Selective Grinding Of Anatomic**

- **Teeth:**

Articulating paper of is used for marking the actual contacts of the teeth.

The diagnostic adjustment was first made on the casts and then on the patient using four differently colored ribbons:

1. Red: centric stops
2. Black: protrusive interferences
3. Green: working side interferences
4. Blue: balancing side interferences

In the first step, cusp form teeth are altered by selective grinding to obtain balanced occlusion when the jaws are in centric relation . Occlusal balance in a lateral direction is obtained by having all of the posterior teeth and the cuspids in contact on the working side and in posterior contact only on the balancing side. In the protrusive balance the anterior teeth should make incisal edge contact at the same time that the tips of the buccal and lingual cusps of the posterior teeth contact.

Evaluate the areas of the tooth contact in the centric and eccentric positions prior to selection of the point or area to be reduced or altered . With the condylar elements against the centric relation stops, close the articulator until the posterior teeth are in contact . The anterior teeth should not be in contact. Examine the lingual cusps of the maxillary posterior teeth and the buccal cusps of the mandibular posterior teeth.

Premature contact is present when the remainder of the teeth fails to make maximum intercuspation. Record the area or areas of premature contact . The contacts may be in varying amounts and may involve more than one cusp or tooth . These varying situations make necessary critical evaluation prior to grinding procedures in the centric position ;however further evaluation in the eccentric positions is necessary before one starts any grinding .

Indications For Selective Grinding:

1. To remove the isolated occlusal interferences, a tooth becomes symptomatic

after the placement of a new, hyperoccluding restoration or following orthodontic treatment (In rare cases, therapeutically-induced changes in occlusion can be associated with the onset of TMD-like symptoms. In such uncommon instances, adjustment of the occlusion may be warranted, as it will reduce the pain and mobility and it will improve function, but it should be undertaken with as little invasiveness as possible.

2. When it is determined that a periodontally involved tooth has more mobility which is because of traumatic occlusion rather than solely to attachment loss.

3. In the treatment of symptomatic fractured teeth or of prosthetically restored teeth which fracture repeatedly.

4. Occasionally, prior to procedures which will result in major occlusal changes, such as prosthetic reconstructions.

5. Followed by orthodontic treatment the correct minor interferences, cannot be corrected solely by tooth movement.

6. As due to limited supportive therapy, e.g. when a tooth in parafunction it becomes hypermobile and hypersensitive, that selective grinding does not replace treatment aimed at decreasing parafunction (In these cases the occlusal contact should be reduced, but not eliminated altogether.

7. Followed by occlusal splint therapy, selective grinding is indicated, once occlusal appliance therapy has eliminated the TMD symptoms, and only if it is determined that the symptoms would vanish permanently, only when occlusal contacts and jaw position provided by the appliance were permanently reproduced in the patient's occlusion.

8. Placement of implant-supported crowns, in order to decrease the incidence of biomechanical complications, such as crown-screw loosening or denture tooth fracture.

Contraindications to Occlusal

Adjustment:

1. The absence of signs and symptoms of TMD

2. The presence of acute orofacial pain and /or dysfunction unrelated to occlusion

3. occlusal adjustment would require grinding beyond the enamel (e.g. slides greater than 2mm).⁷

Working side Occlusal errors and their

Correction:⁹

On the working side there are six types of occlusal inaccuracy. It's a rule that the centric holding cusps are not grinded. These are: Maxillary lingual cusps and Mandibular buccal cusps. These cusps are essential to keep the recorded vertical dimension. If interferences exist in the working side reduces either the "Maxillary buccal cusps lingual inclines or the Mandibular lingual cusps buccal inclines." This is called B.U.L.L. rule.

(1) The maxillary buccal cusp and the mandibular lingual cusp are too long. For correcting this error the length of the cusp is reduced by grinding in order to change the incline extending from the central fossae to the cusp tip. The central fossae are not deepened, but the maxillary buccal cusps

and the mandibular lingual cusps are reduced so that the other tooth is in contact in this position.¹⁰

2) The buccal cusps are in contact, but the lingual are not. For correcting this error the maxillary buccal cusps are ground from the central fossae to the cusp tip in order to reduce the cusp and to change the lingual cusp incline to become less steep.

(3) The lingual cusps are in contact, whereas the buccal are not. For correcting this error the mandibular lingual cusps are reduced by grinding their buccal incline. The maxillary palatal cusp is not reduced, and the central fossae is not deepened.

(4) The maxillary buccal or palatal cusps are positioned more mesially from their intercusp position. This error can occur together with any of these three errors already described. For its correction the mesial inclines of the maxillary buccal cusps are ground distally as if they were narrowed, and the distal inclines of the mandibular cusps are ground forwards. In this way the same cusp incline is obtained.

(5) The maxillary buccal or lingual cusps are positioned more distally from their intercuspal position. This error can also occur together with buccolingual errors. For its correction grinding is performed on the maxillary cusps distally and on the mandibular cusps mesially.

(6) The teeth on the working side can be out of contact. The cause of this error is an intense contact on the non-working side.

Conclusion

Every occlusal indicator material has its own advantages and disadvantages. The peripheral area of the occlusal registration with a higher chromatic intensity that is obtained with a thick articulating paper should not be eliminated during occlusal adjustment. The central area of the registration with a lower chromatic intensity is the real occlusal contact and correlates with the results obtained using a thinner articulating paper. Even though determining a correct occlusion is a challenging task, T-Scan has been widely used in dentistry nowadays and claims to correct the occlusion. Even though the accuracy and

ability to get repeatable reading with the T-Scan has been questioned by different studies, it acts as useful occlusal mapping device to record the pattern of occlusion.

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Conflicts of interest :

There are no conflicts of interest.

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