An Review on Occlusal Plane Analysis in Dentulous Patients

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Abstract

The position of the occlusal plane forms the basis for the ideal teeth arrangement. Incorrect records of the occlusal plane would hamper aesthetics, phonetics, and mastication. It may affect the stability of a complete denture and ultimately result in alveolar bone resorption.Because the term plane refers geometrically to a flat surface, it is not entirely correct to describe the occlusal surface as following a true plane.

The form of the occlusal plane is directly related to specific functional requirements. In addition to the alignment of teeth in relationship to the arc of closure for best resistance to loading, it should permit ease of access for positioning of the food on the occlusal surfaces. This article is a review of the simple methods of analysing the occlusal plane in dentulous plane and correcting the occlusal problems in these patients.

Keywords: *occlusal plane,simplified occlusal plane analyzer, Broadrick occlusion plane analyzer*

Introduction

Determination of the occlusal plane is one of the most important clinical procedures in prosthodontic rehabilitation of edentulous patients. The position of the occlusal plane forms the basis for the ideal teeth arrangement[1]. Anteriorly occlusal plane helps in achieving aesthetics and phonetics while posteriorly it forms a milling surface where the tongue and buccinator muscle position the food bolus and hold it during mastication[2]. Incorrect records of the occlusal plane would hamper aesthetics, phonetics, and mastication. It may affect the stability of a complete denture and ultimately result in alveolar bone resorption.

OCCLUSAL PLANE DETERMINATION AND ITS ESTABLISHMENT

Determining the Plane of Occlusion

The term of the plane of occlusion refers to an imaginary surface that theoretically touches the incisal edges of the incisors and tips of the occluding surfaces of the posterior teeth[2]. The plane of occlusion represents the average curvature of the occlusal surfaces. A correct plane of occlusion allows protrusion without posterior interference. It allows non-interfering lateral excursions without loss of function on the working side. The occlusal plane problem that is most detrimental to esthetics is the slanted plane, which is high on one side and low on the other. The leveling of the occlusal plane always starts with the anterior teeth for the following two reasons.

Esthetics: The location of the incisal edge position relates to the smile line and determines the incisal plane, which is the anterior starting point for the occlusal plane on each side. For best esthetics, it is an absolute requirement that the incisal plane is parallel with the interpupillary line[3].

Function: Since the functional acceptability of any occlusal plane is primarily related to letting the anterior guidance do its job, the anterior segment must be organized before we can know how effective the anterior guidance can be in disoccluding the posterior teeth. The importance of the occlusal plane increases as the steepness of the anterior guidance decreases. The flatter the anterior guidance, the less capable it is of disoccluding a severely curved occlusal plane.

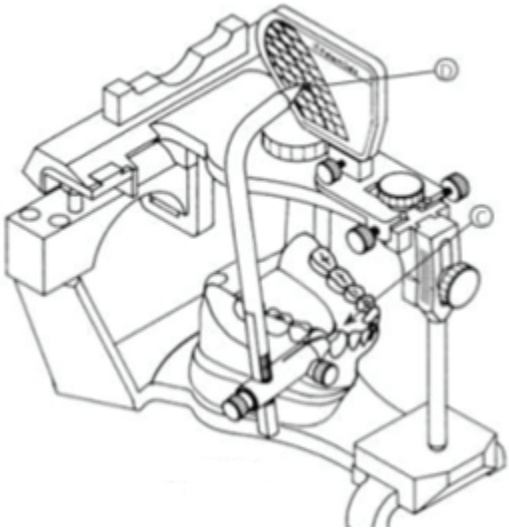
Examination for Occlusal Plane Problem

Ask the patient to protrude the mandible. If the anterior teeth are separated by the posterior teeth,

there is a problem with the occlusal plane. Because the condylar path is so important to protrusive disocclusion of the posterior teeth, condylar paths should be recorded at least by a protrusive interocclusal record, when an occlusal plane problem exists. The steeper the condylar path is in protrusive, the better able it is to help the anterior guidance disocclude the posterior teeth[4].

Determining an Acceptable Occlusal Plane for Restorative Cases Using a simplified occlusal plane analyzer (SOPA)

An ideal occlusal plane starts at the canine tip and goes through the condylar axis. If all positive cusp tips relate to this plane, the disclusion of posterior teeth is never a problem. However, remember that this is an arbitrary plane based on an arc around a survey point that is 4inches from the tip of the canine[5]. It is an excellent aid for establishing an ideal occlusal plane if all posterior teeth are to be restored. It should not be used to determine whether or not restorations are necessary.



SIMPLIFIED OCCLUSAL PLANE ANALYSER

ü A SOPA is preset at 4 inches from the condylar axis. The SOPA works with Dénar® (Teledyne Waterpik™) articulators. The Broadrick flag accomplishes the same occlusal analysis on almost all types of semi-adjustable articulators.

ü By setting the caliper scribe at 4 inches and aligning the marking the point at the tip of the canine, an occlusal plane can be scribed on the lower cast that will go through the condylar axis in one simple step.

ü A line drawn on the cast represents an acceptable occlusal plane. The caliper scribe can be lengthened to a preparation height. This process is only used if the posterior teeth are to be restored. It is never used to determine whether or not teeth must be prepared.

ü A simple wax index can be adapted to the cast and the desired occlusal plane can be scribed on the wax, which is then trimmed to the line.

ü With the wax index in place, the teeth can be marked to the indicated preparation height and occlusal plane.

ü Tooth reduction that follows the predetermined preparation height and contour ensures that there will be sufficient room for restorative materials when the restorations are fabricated. Preparations are completed after the occlusal reduction is verified[6].

Occlusal plane analyzer (BOPA)

Broadrick occlusion plane analyzer: When it has been determined that restoration of all or most of the posterior teeth is necessary, the PMS technique using BOPA provides a simple and practical method to assist in determining the preliminary occlusal plane on diagnostic casts[8]. Proper use of the occlusion plane analyzer will accomplish the following:

ü Preliminary determination of an acceptable plane of occlusion on the study model as an aid in treatment planning.

ü Preliminary determination of the amount of reduction that will be required when each tooth is prepared.

ü Extremely simple transfer to the mouth of the predetermined preparation height for each tooth.

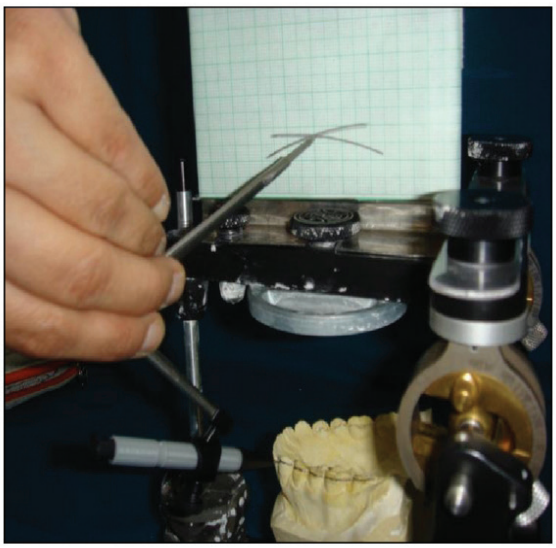
ü In laboratory wax-up simple determination of the height of each cusp tip.

ü The predetermination of both cusp height of the finished restoration and also the height of each prepared tooth. Thus, room for a sufficient thickness of metal or metal and porcelain can be assured in advance.

ü A properly predetermined plane of occlusion on the lower arch which enables the dentist to select

virtually any type of acceptable occlusion contour scheme with complete assurance that the established plane of occlusion will permit it.

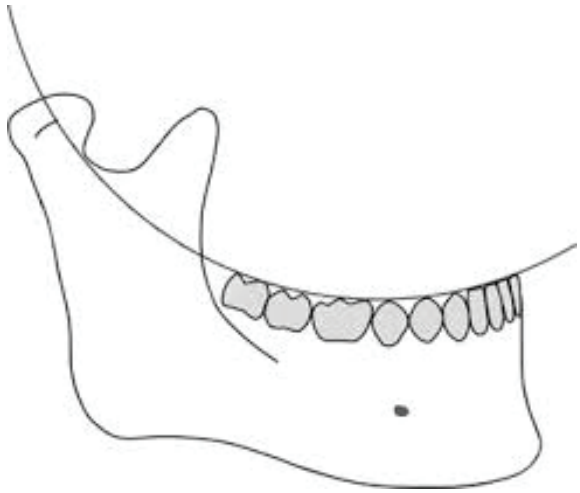
The BOPA has now been adapted to only a few articulator systems, such as the Denar Anamark Fossae (Teledyne Waterpik, Ft Collins, Colo) and all models of Hanau articulators (Teledyne Waterpik)[9]. For those manufacturers of semi-adjustable articulators who do not offer such occlusal plane analyzers for use with their instruments, custom made clear acrylic resin BOPA may be fabricated.



Technique of using BOPA consist of the following steps

ü The flag is attached to the upper member of the articulator. A sheet of blank paper is attached to both sides of the flag to receive the markings. The maxillary cast is removed from the articulator, and the flag is attached on top of the upper member of the articulator. The anterior survey point (ASP) is chosen on the midpoint of the disto-incisal edge of the mandibular left canine from which a long arc with a 4-inch radius is drawn on the flag with a compass. The posterior survey point (PSP) is located on the distobuccal cusp of the mandibular left second molar and a short arc is drawn on the flag to intersect the long arc at the center of the anteroposterior curve. The point of the compass is placed at the center of the anteroposterior curve on the flag, and a 4-inch radius is drawn through the buccal surfaces of the mandibular teeth.

ü Another line termed the "preparation line", is scribed by opening the compass by an amount equal to the desired occlusal thickness of the proposed restoration. A softened modeling wax sheet is adapted to the buccal surfaces of the mandibular cast. The wax is cut carefully back to this line and trimmed along the mucobuccal fold so that the wax could be fitted accurately against the teeth intraorally, and this is termed the "occlusal plane cutting guide".



BroadricksCurve

When preparing the mandibular posterior teeth, the cutting guide is placed snugly against the buccal surfaces of the dried teeth, and the entire occlusal surface of each tooth is reduced to the preparation line. Following occlusal reduction, the teeth are prepared according to the predetermined treatment plan[10].

CORRECTING THE OCCLUSAL PLANE PROBLEMS

There are two basic approaches to solving occlusal plane problems[11].

1. Leveling or flattening the occlusal plane, so that it can be disoccluded by existinganterior guidance.

2. Steepening the anterior guidance, so that it can disocclude existing occlusal plane, whichremains unchanged.

3. Combination of above 2 methods

The steepening of anterior guidance depends on 4 factors.

1. Envelope of function
2. Arch relationship
3. Esthetic factor
4. Periodontal support

Envelope of function is the principal determinant of anterior guidance, so any steepening of the anterior guidance can result in restriction of the established pattern of function. However, when occlusal plane problems separate the anterior teeth in protrusive, it is often possible to eliminate the posterior interferences by selective grinding so that anterior contact can be maintained from centric relation forward to the incisal edge to edge position. Certain arch relationships may contraindicate restorative alteration of the anterior guidance. If anterior teeth are in a stable relationship with strong tongue or lip pressure related to an anterior open bite or a severe over jet, it may create instability if the teeth are moved or restored to contact.

Esthetics is often a key factor in determining what to do with a slanted or uneven occlusal plane. When teeth on one side have been unopposed, it is sometimes very difficult to level both sides because of severe elongation on the unopposed side. Periodontal support around the anterior teeth is critical if the anterior guidance is steepened to disclude the posterior teeth. If steepening the anterior guidance restricts habitual patterns of function, there will be a tendency for increased horizontal stress on the anterior teeth.

Summary and Conclusion

The form of the occlusal plane is directly related to specific functional requirements. In addition to the alignment of teeth in relationship to the arc of closure for best resistance to loading, it should permit ease of access for positioning of the food on the occlusal surfaces. In the dentulous subjects, a significant association was seen between the occlusal maxillary plane angle and maxillomandibular space length and height.

1. In the long and low subtype of maxillomandibular space, the occlusal maxillary plane angle is least. The occlusal plane tends to be parallel to the maxillary plane.

2. In the short and high subtype of maxillomandibular space, the occlusal maxillary plane angle has the maximum value. The occlusal plane is more angulated to the maxillary plane.

3. In the short and low and long and high subtypes of the maxillomandibular space, mean value of occlusal maxillary approximates the mean of the entire group.

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