

A device for occlusal plane determination

Abdul Haque Maqsood Ahmed Inamdar, Shankar Pandharinath Dange, Kishor M Mahale, Smita Arun Khalikar

Department of Prosthodontics, Government Dental College and Hospital, Aurangabad, Maharashtra, India

Abstract

The correct orientation of the occlusal plane is the first and one of the important steps while recording jaw relationships in an edentulous patient. One of the most popular methods is to orient the occlusal plane to interpupillary line anteriorly and ala-tragus lines posteriorly which is usually accomplished by repetitive adjustment of the maxillary rim until a hand-held Fox's plane appears to be parallel to these lines. However, this process is time-consuming and error-prone. The eventual plane is almost always an educated guess, and this can be difficult for a new student. The device presented in this article marks the occlusal plane on wax rims parallel to interpupillary line anteriorly and the ala-tragus lines posteriorly, and thus, occlusal plane can be oriented in one simple step, thereby saving time and increasing efficiency of the operator.

Keywords: Ala-tragus line, interpupillary line, occlusal plane, orientation

Address for correspondence: Dr. Abdul Haque Maqsood Ahmed Inamdar, 231, Department of Prosthodontics, Government Dental College and Hospital, Aurangabad - 431 001, Maharashtra, India.
E-mail: iabdulhaque@gmail.com

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INTRODUCTION

Determination of the occlusal plane is the first clinical step for recording maxilla-mandibular relationships of edentulous patients. Occlusal plane is defined as "the surface of wax occlusion rims contoured to guide in the arrangement of teeth."^[1] Esthetics and phonetics determine the anterior height of the occlusal plane and the function of the tongue and cheek muscles determine the posterior plane.^[2] Even 5° deviation of the occlusal plane from the ala-tragus line was reported to have effects on biting forces during maximum clenching.^[3] It is believed that teeth oriented on an occlusal plane in harmony with the individual's physiognomy are responsible, in part, all conditions being equal, for stable, retentive full dentures.^[4]

The most common technique is to hold an occlusal plane guide in position against the upper rim and to hold a straight edge-up against the face at interpupillary line anteriorly and camper's line posteriorly.^[5] Adjustments are made until the desired occlusal plane orientation is achieved. Even this procedure is not an easy task for a nervous student.^[6] Final orientation is nothing but an educated guess.

Previously, several authors have modified Fox's plane into custom-made devices to study the relationship of ala-tragus line to occlusal plane in dentate patients.^[7-9] Occlusal plane orientor devised by Kuniyal *et al.* was used to orient maxillary plane to the ala-tragus line in edentulous patients, but the device lacked any posterior determinants of the plane.^[10]

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This device was made to overcome the drawbacks of the conventional method. This device orients the modified Fox plane parallel to interpupillary line anteriorly and camper's line posteriorly which is then used to mark grooves on occlusion rim. The maxillary occlusal rim can then be adjusted accordingly in one attempt to get the desired occlusal plane orientation.

Technique

The device is made from different thickness of continuous cast acrylic sheets (Shinkolite, Thai MMA Co., Ltd., Thailand) except the modified intraoral component. Cast acrylic is nothing but a polymethyl methacrylate-based transparent thermoplastic with superior surface finish and flatness. It is a light-weight material with adequate strength. Modified intraoral components are made up of 3-mm thickness polycarbonate sheets (Lexan™ F2500 Sheet, SABIC, Saudi Arabia) which are autoclaved at 121°C at 15 lbs pressure for 15 min before use.

The device has the following components:

1. Head strap which stabilizes and supports the device in position
2. Interpupillary line indicator [Figure 1a]
3. Adjustable right and left ala-tragus line indicators [Figure 1b]

The adjustable ala-tragus line indicators can be moved over a semicircular hinge and thus, it allows any part of the tragus, i.e., superior, middle, and inferior to be considered while establishing the occlusal plane in accordance with clinician's preference and requirements of the patient

4. Three U-shaped rectangular frames with an inner attachment for modified Fox's plane [Figure 2a and b]
5. Modified Fox's plane with movable intraoral component [Figure 3]

Adjustable intraoral components are approximated by a slide mechanism. After approximation, they can be held in place using screws

6. Thumb screws are used to assemble all the components together

Wear and tear of the thumbscrews or corresponding acrylic portion are negligible. The thumb screws may be replaced as and when needed.

Assembled parts of the device frame are affixed with pharmaceutical grade cyanoacrylate adhesive (Fevikwik 203, Pidilite Industries Ltd., Mumbai, India) which has low viscosity and fast setting time.

Steps in occlusal plane determination:

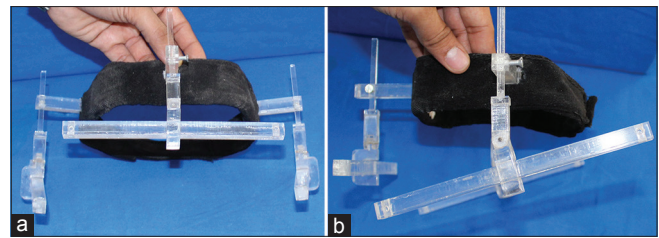


Figure 1: (a) Head strap with three indicator lines. Front view original. (b) Head strap with three indicator lines. Side view original

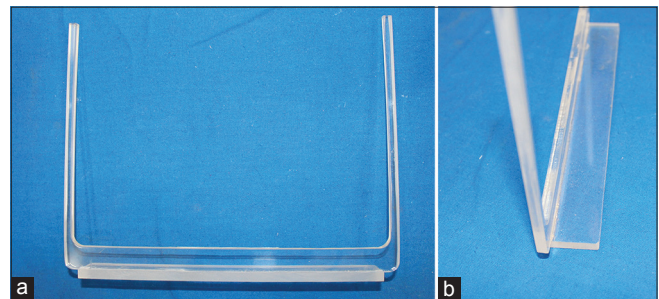


Figure 2: (a) U-shaped rectangular frames with inner attachment for modified Fox plane. Front view original. (b) U-shaped rectangular frames with inner attachment for modified Fox plane. Side view original

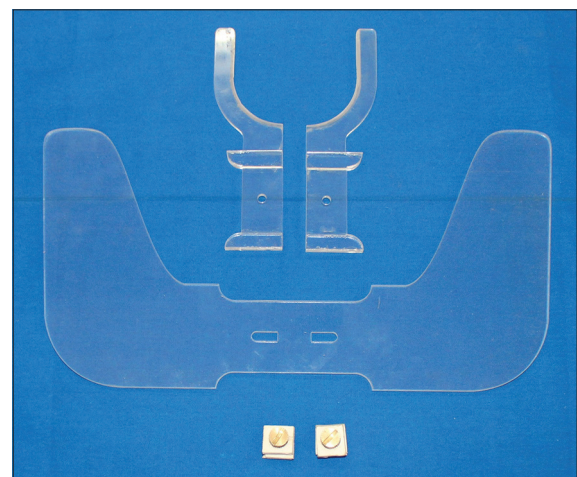


Figure 3: Modified Fox' plane with movable intraoral component original

1. Prepare stable record bases and check intraorally for stability and comfort
2. Seat the patient in an upright position, looking straight ahead with ala-tragus line parallel to the floor
3. Make the occlusal rims in the usual manner and keep the overall height in excess initially
4. Check the maxillary occlusion rim for labial fullness and lip support
5. Adjust the anterior height of wax rim in accordance with esthetics and phonetics
6. Stabilize the device on the patient's forehead using the head strap. Care was taken to match the center pointer with the facial midline of the patient

7. Orient the three indicator bars parallel to the desired landmarks
8. Attach three U-shaped rectangular frames to respective indicator bars [Figure 4]
9. Adjust the levels of each U-shaped frame in accordance with the desired anterior height of the wax rims
10. Verify parallelism of all the U-shaped frames with respective indicator lines and lock the frames at desired levels using thumbscrews [Figure 5a and b]
11. Remove the device from patients head carefully without disturbing the orientation of three U-shaped frames and position the modified fox plane at the inner aspect of the device using special rests designed to hold it
12. Seat the device again on the patient's head and verify the parallelism of each U-shaped frame with respective indicator lines and landmarks
13. Ask the patient to open the mouth wide and bring both the jaws of intraoral marker together until it makes clear indentations all over the wax rims [Figure 6]

14. Remove the device from the patient's head and adjust the wax rim according to the indentation made by the intraoral marker [Figure 7a and b]
15. Thus, the plane is established parallel to interpupillary line anteriorly and right and left ala-tragus lines posteriorly at desired vertical height [Figure 8a and b].

DISCUSSION

In the past, authors have used the custom-made occlusal analyzer to study the relationship of the ala-tragus line to the occlusal plane in natural dentition.^[7-9] Shigli *et al.*^[7] have termed the custom-made device as “occlusal plane relator” in which anterior plane indicator line was joined to right and left ala-tragus line indicator using a hinge joint, and Fox's plane was used as the occlusal plane indicator. Both the planes were held together using a vertical arm.

The custom-made “occlusal plane analyzer” devised by Gupta and Singh^[8] had metal plates denoting interpupillary line and right and left ala-tragus line indicator joined to Fox's plane using four long screws at the ends of the occlusal plane indicator. A metal key was used to move the metal plates up and down. Shetty *et al.*^[9] used custom-made



Figure 4: Adjusted interpupillary line indicator original

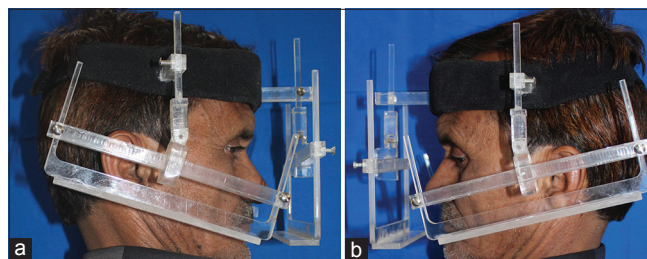


Figure 5: (a) Adjusted right and left ala-tragus line indicator right view original. (b) Adjusted right and left ala-tragus line indicator left view original



Figure 6: Modified Fox's plane in place original

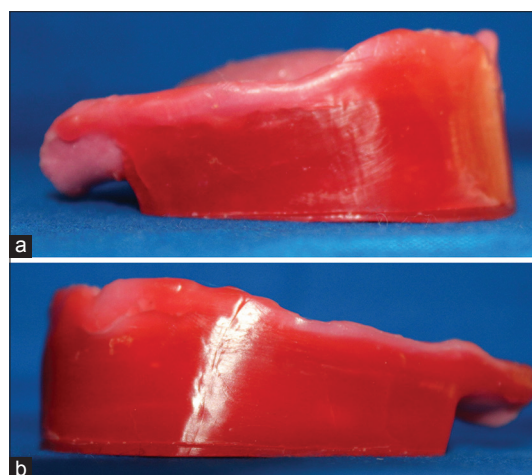


Figure 7: (a) Lines marked on the wax rim with intraoral marker right view original. (b) Lines marked on the wax rim with intraoral marker left view original

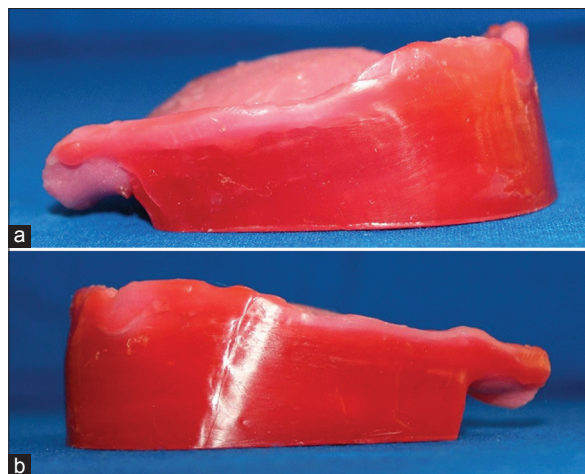


Figure 8: (a) Corrected maxillary rim right view original. (b) Corrected maxillary rim left view original

occlusal plane analyzer which lacked an anterior reference plate. They had joined two metal plates as the right and left ala-tragus line indicators using a Tofflemire retainer which was laser welded to the extraoral arm of Fox's plane. None of these custom-made devices have markers to denote the occlusal plane on wax rims as they were used in dentate patients to study the orientation of the occlusal plane in respect to the ala-tragus line.

“Occlusal plane orientor” devised by Kuniyal *et al.*^[10] is a device which can be used to mark the occlusal plane on occlusal wax rims in relation to the interpupillary line and ala-tragus lines. The shortcoming of the device is the inability to adjust the posterior level of the ala-tragus lines. There is disagreement between authors on the definition of the ala-tragus line due to differing views on the exact point of reference, on the ala and especially on the tragus.^[7] Review of the literature on occlusal plane location in edentulous patients suggests that all the three points on tragus, i.e., superior, middle, and inferior can be used as guides for occlusal plane orientation.^[11] Furthermore, it is assumed that the direction of the occlusal force is influenced by the various types of facial morphology in natural dentition.^[12] Ogawa *et al.* have demonstrated a correlation between the inclination of the occlusal plane and the mandibular closing path during masticatory movements outside of the intercuspal range.^[13]

This device enables the clinician to change the ala-tragus indicator lines in accordance with facial form, functional requirements and clinician's own preference. This is an objective way to determine the occlusal plane parallel to desired landmarks in a single step procedure. This device can be a helpful tool for a new student. The same device can also be used for future studies to assess the

relationship of the occlusal plane to the ala-tragus line or other landmarks.

SUMMARY

The occlusal plane can be adjusted in one simple step as this device marks the occlusal plane on wax rims parallel to interpupillary line anteriorly and ala-tragus lines posteriorly, thereby saving time and increasing the efficiency of the operator. Furthermore, the posterior plane can be oriented in accordance with functional requirements and clinician's preference.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understand that names and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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