

Anterior point of reference: An outlook in Prosthodontics

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ARTICLE INFO



Keywords:

Anterior point of reference, orbitale,
Facebow transfer.

ABSTRACT

Three points in space determine the position of the maxillary cast in an articulator. The dentist is most frequently concerned with selecting the posterior two of the three reference points. In addition, the dentist will, either consciously or unknowingly, select the anterior of these points of reference. This decision will affect the development of occlusion and esthetic. It is also believed that, during a face-bow transfer, it is important to transfer it to the articulator, not only the anteroposterior and lateral relationship of the maxillae to the glenoid fossae, but also the vertical relationship. Many anterior reference points have been described and advocated to achieve this end. This paper explores the review of recent concepts and its practical implications regarding anterior point of reference in prosthodontics.

Introduction

Oral rehabilitation requires fabrication of restorations or prostheses that are in harmony with the functional movements of the mandible to ensure physiologic acceptance.¹

Orientation of the maxillary cast in an articulator is a requisite of several techniques used in dentistry. Its utmost objectives are the restoration of occlusion in well controlled form and position of the teeth. The knowledge of dentist and auxiliary will determine how well these objectives are satisfied. The maxillary cast in the articulator is the baseline from which all

occlusal relationships start, and it should be positioned in space by identifying three points of different orientation which cannot be on the same line. The plane is formed by two points located posterior to the maxillae and one point located anterior to them².

Anterior reference point is the point located on the mid face that, together with two posterior reference points, establishes a reference plane. Whereas posterior reference point are located one on each side of the face in the area of the transverse horizontal axis, which, together with an anterior reference point, establish the horizontal reference plane.³⁻⁶

In the fabrication of complete or partial dentures, clinicians frequently require one or more reference planes that could be used in accurate positioning of cast models on an articulator. The articulator, a mechanical device which simulates the movement of the jaw and mutual relations of the teeth during functioning, is essential for diagnostic and therapeutic procedures.² Therefore, transfer of a cast of the jaws into the articulator using suitable reference points is deemed necessary. Various opinions have been expressed in literature on the mutual relations of reference planes used in the prosthetic care of patients. The evolution of reference planes was primarily related to the restoration of occlusion in well-controlled form and position of the teeth^{7,8}

Many clinicians have stated that the appropriate selection of a third or posterior point of reference on the Frankfort horizontal plane is essential in prosthetic procedures for esthetic reasons as well as the establishment of a correct plane of occlusion. One study of 21 edentulous patients showed that the relationships of the planes of reference are not maintained in transfer from the patient to the articulator.⁹

In another study of 87 dentulous dental students, the variability of the relationship of the planes of reference was described.¹⁰ Keeping all these things in mind, authors have genuinely attempted to review the basic ideology and conceptual applications of different reference points and planes used in routine prosthodontic rehabilitative procedures.

WHY ITS NECESSARY TO RECORD THE ANTERIOR POINT OF REFERENCE

The selection of the anterior point of the triangular spatial plane determines which plane in the head will become the plane of reference when the prosthesis is being fabricated. The dentist can ignore but cannot avoid the selection of an anterior point. The act of affixing a maxillary cast to an articulator relates the cast to the articulator's hinge axis, to the vertical axes, to the condylar determinants, to the anterior guidance, and to the mean plane of the articulator. The act achieves greater importance by the use of a constant third point of reference and repeatable posterior points of reference. When three points are used the position can be repeated, so that different maxillary casts of the same patient can be positioned in the articulator in the same relative position to the end-controlling guidances.^{11,12}

Various Third point of reference

Accurate selection of the reference point is a very critical step in oral and maxillofacial rehabilitation procedures. One should have thorough knowledge of the following anterior points and the rationale for the selection of each¹³

1. Orbitale (B) Located by Hanau face bow with help of orbital pointer.
2. Orbitale minus 7 mm. (C) This plane represents Frankfort plane
3. Nasion (A) minus 23mm Used with quick mount face bow (Whip mix) .
4. Ala of nose (D) This plane represents campers plane
5. 43 mm superior from lower border of upper lip/ lateral incisor (Denar reference plane locator/ artexmeter).
6. Incisal edge plus articulator midpoint to articulator axis: Horizontal plane distance.

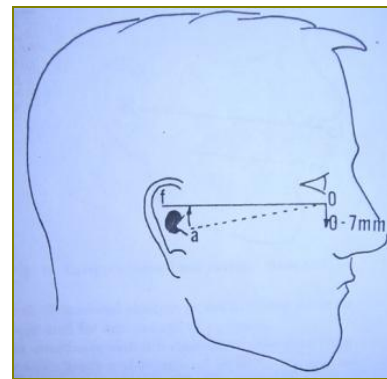
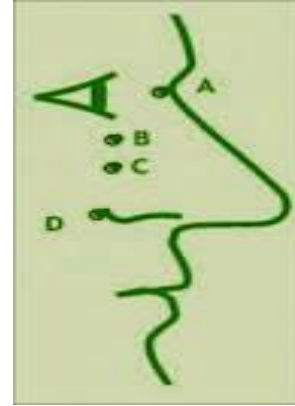
Orbitale

Orbitale is the lowest point of the infraorbital rim of skull which can be palpated on the patient through the overlying tissues and the skin. One orbitale and the two posterior points that determine the horizontal axis of rotation will define the axis – orbital plane.²

Orbitale and the two posterior landmarks defining the plane are transferred from the patient to the articulator with the face- bow. The articulator must have an orbital indicator guide. Relating the maxillae to this plane will slightly lower the maxillary cast from the position that would be established if the Frankfort horizontal plane were used. Practically, the axis- orbital plane is used because of the ease of locating the marking orbitale and because the concept is easy to teach and understand. Orbitale is transferred from the patient to this guide by means of the orbital pointer on the anterior cross arm of the face bow.^{12,13,14}

Orbitale minus 7 mm

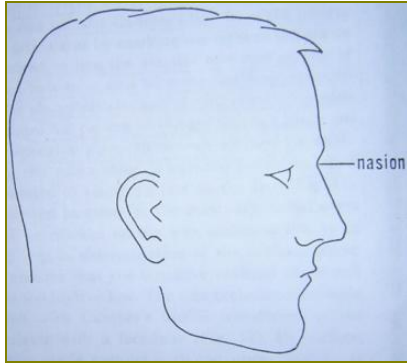
The Frankfort horizontal plane passes through both the poria and one orbital point. Because poria is a skeletal landmark, Sicher' recommended to use the midpoint of the upper border of the external auditory meatus as the posterior cranial landmark on a patient. Most articulators do not have a reference point for this landmark. Gonzalez' pointed out that this posterior tissue landmark on the average lies 7 mm superior to the horizontal axis.²The recommended compensation for this discrepancy is to mark the anterior point of reference 7 mm below orbitale on the patient or to position the orbital pointer 7 mm above the orbital indicator of the articulator. Later on Bergstrom developed Arcon articulator that automatically compensates for this error by placing the orbital index 7 mm higher than the condylar horizontal axis. In either technique,



Frankfort horizontal plane of the patient becomes the horizontal plane of reference in the articulator.³

Nasion minus 23 mm

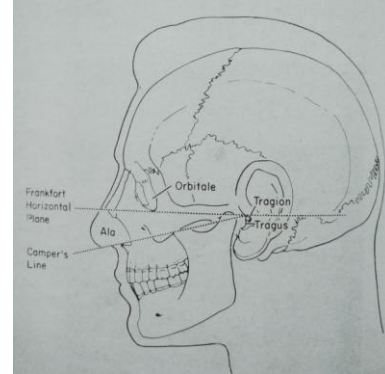
This reference point is widely used with Whip Mix Face Bow. The nasion can be approximately located in the head as the deepest part of the midline depression just below the level of the eyebrows. The nasion guide, or positioner, or relator of the Quick Mount face - bow, which is specially designed to be used with the Whip-Mix Articulator, fits into this depression. This nasion relator can be moved only in an in and out motion and not in up and down, from its attachment to the face-bow crossbar. The crossbar is located 23 mm below the midpoint of the nasion positioner. When the face-bow is positioned anteriorly by the nasion relator, the crossbar will be in the approximate region of orbitale.^{9,12,13,14}



The face bow crossbar and not the nasion relator is the actual anterior reference point locator. While doing the face-bow transfer, the crossbar of the face bow supports the upper frame of the Whip Mix articulator. The inferior surface of the frame is in the same plane as the articulator's hinge points. From this it can be concluded that the Quick Mount face-bow used with the Whip-Mix articulator employs an approximate axis orbital plane. That is why; locating the orbital point with this method is largely dependent upon the large nasion relator, the morphologic characteristics of the nasion notch, and the inconsistency of the nasion-orbitale measurement from 23 mm in the patient.^{12,15,16}

Incisal edge plus articulator midpoint to articulator axis-horizontal plane distance

A reasonable and consistent position for the master casts in the articulator would be one which would position the plane of occlusion near the mid-horizontal plane of the articulator. Any deviation and divergence from this scheme may position the casts high or low relative to the instrument's upper and lower arms.^{9,12,15,16,17} The overall deleterious effect of these positions may be inaccurate and vague occlusal relationships due to dimensional changes in the gypsum products used for cast-articulating purposes. In accordance with this concept, the distance from the articulator's mid-horizontal plane



to the articulator's axis-horizontal plane is measured. This same distance is measured above the existing or planned incisal edges on the patient, and its uppermost point is marked as the anterior point of reference on the face. This point can be recorded for future use by measuring vertically downward to it from the inner canthus of the eye and recording this measurement. The inner canthus is used because it is accessible unchanging landmark on the head. It must be documented that this method does not relate the Frankfort plane or the axis-orbital plane parallel to the horizontal plane. Additionally, only the incisal edges or the most anterior portion of the occlusal plane will be midway between the upper and lower articulator arms.^{18,19}

Alae of the nose

In most of the conventional complete denture techniques it is imperative to make tentative or the actual occlusal plane parallel with the horizontal plane. This relationship can be achieved as a line from the ala of the nose to the center of the auditory meatus that describes Camper's line. An alternative method of establishing this relationship is to make a wax occlusion rim parallel to Camper's line on the face. The desired location for the maxillary incisal edge should be marked on the wax occlusion rim as an initial step in determination of the occlusal plane. This actually assures that the tentative occlusal plane will not be too high or low.¹²

Selection of anterior reference point: Practical considerations

¹ Selection of the right anterior point of reference is highly subjective which necessitate special attention during its selection. A well designed and precise selection of the anterior reference point will allow the dentist to clearly visualize the anterior teeth and the occlusion in the articulator in the same frame of reference that would be used when looking at the patient. The objective is usually to achieve a natural appearance in the form and the position of the anterior teeth. Articulating the maxillary cast relative to the Frankfort horizontal plane will attain this goal.^{19, 20, 21, 22, 23}

2. When this reference plane is used, the teeth will be viewed as though the patient were standing in a normal postural position with the eyes looking straight ahead. One of very common dilemma occurs between the dentist and the laboratory technicians when they apply different objectives to the same patient. The dentist may very well have positioned the maxillary cast in relation to the Frankfort horizontal plane or used one of the other more superior anterior points of reference.^{24, 25, 26} Laboratory personnel may then proceed to establish the occlusal plane parallel to the horizontal or parallel to the upper and lower articulator arms. The result will be an occlusal plane that drops from anterior to posterior when placed in the patient's mouth. The consequences of the contrary circumstances will also be disadvantageous to the patient. Camper's line can be used as the reference for the articulation of maxillary cast.¹²

The laboratory technician may then arrange the anterior teeth and the occlusal plane as though the Frankfort horizontal plane were being used. The result will be an occlusal plane that rises severely from anterior to posterior in the patient's mouth and maxillary anterior teeth that may be excessively positioned lingually. The

following technique can be used as more convenient, practical and less time-consuming alternative option.^{27, 28, 29, 30}

- If the Camper's line - horizontal reference plane is used, raise the back of the articulator to achieve the effect of the Frankfort horizontal plane mounting
- If the Frankfort horizontal plane reference is used, raise the anterior of the articulator to achieve the effect of paralleling the occlusal plane and Camper's line with the horizontal.

CONCLUSION

Three points in space determine the position of the maxillary cast in an articulator. So the dentists especially Prosthodontists are more repeatedly concerned with selecting the posterior two of the three reference points. Though one must be aware of the relative significance of posterior reference points and should consider anterior reference point as one of the critical dimension during face bow transfer. Such assessment will definitely affect the development of normal occlusion and associated dentofacial aesthetics. Furthermore dentist must have thorough knowledge of these reference planes and points and should utilize them depending on the case without any misunderstanding with the laboratory personals.

REFERENCES

1. Wilcox CW, Sheets JL, Wilwerding TM. Accuracy of a fixed value nasion relator in facebow design. *J Prosthodont* 2008;17:31-4.
2. Wilkie ND. The anterior point of reference. *J Prosthet Dent* 1979;41:488-96.
3. McCollum BB. The mandibular hinge axis and a method of locating it. *J Prosthet Dent* 1960;10:428-35.
4. Lauritzen AG, Wolford LW. Hinge axis location on an experimental basis. *J Prosthet Dent* 1961;11:1059-67.
5. Zarb GA, Bergman B, Clayton JA, MacKay HF. *Prosthetic treatment for partially edentulous patients*. St. Louis: The C. V. Mosby Co., 1978. p. 193.
6. *The Glossary of Prosthodontic Terms*. 8th ed. *J Prosthet Dent* 2005;94:10-92.
7. Zarb GA, Bolender CL. *Prosthodontic Treatment for Edentulous Patients: Complete Dentures and Implant-Supported Protheses*. 12th ed. St. Louis: Mosby; 2004. p. 262.
8. Weisgold AS. Occlusion in dental curriculum. *J Prosthet Dent* 1962;49:419^l
9. Gonzalez JB, Kingery RH. Evaluation of planes of reference for orienting maxillary casts on articulators. *J Am Dent Assoc* 1968;76:329.
10. Olsson A, Posselt U. Relationship of various skull reference lines. *J Prosthet Dent* 1961;11:1045.
11. Lundstorm F, Lundstrom A. Natural head position as basis for cephalometric analysis. *Am J Orthod Dentofacial Orthop* 1992;101:244-7
12. Ercoli C, Graser GN, Tallents RH, Galindo D. Face-bow record without a third point of reference. Theoretical considerations and an alternative technique. *J Prosthet Dent* 1999;82:237-41.
13. Bailey JO Jr, Nowlin TP. Evaluation of the third point of reference for mounting maxillary casts on the Hanau articulator. *J Prosthet Dent* 1984;51:199-201.
14. Pitchford JH. A reevaluation of the axis-orbital plane and the use of orbitale in a facebow transfer record. *J Prosthet Dent* 1991;66:349-55.
15. Bergstrom G. On the reproduction of dental articulation by means of articulators. *Acta Odontol Scand Suppl* 1950;9:3-149. 17.
16. McWilliam JS, Rausen R. Analysis of variance in assessing registrations of natural head position. *Swed Dent J* 1982;15:239.]
17. Krueger GE, Schneider RL. A plane of orientation with an extracranial anterior point of reference. *J Prosthet Dent* 1986;56:56-60.
18. Frankel R. The applicability of the occipital reference base in cephalometrics. *Am J Orthod* 1980;77:379.
19. Beck. A clinical evaluation of the Arcon concept of articulation. *J Prosthet Dent* 1959;9:409.]
20. Augsburg KI. Occlusal plane relation to facial type. *J Prosthet Dent* 1953;75:5. 22.
21. Bjerin R. A comparison between the Franklorr horizontal and the Sella Turcica - Nasion as reference planes in cephalometric analysis. *Acta Odontol Scand* 1957;1:15.
22. Downs WB. The role of cephalometrics in orthodontics. Case analysis and diagnosis. *Am J Orthod* 1952;38:162.
23. Lundstrom A. Head posture in relation to slope of the sella-nasion line. *Angle Orthod* 1982;5:279.

24. Brandrup-Wognsen T. Face-bow, its significance and application. *J Prosthet Dent* 1953;3:618-30. 26.
25. Dos Santos Junior J, Nelson SJ, Nummikoski P. Geometric analysis of occlusal plane orientation using simulated ear - rod facebow transfer. *J Prosthodont* 1996;5:172-81.
26. Olsson A, Posselt U. Relationship of various skull reference lines. *J Prosthet Dent* 1961;11:1045-9.
27. Hanau RL. Articulation defined, analyzed and formulated. *J Am Dent Assoc* 1926;13:1694-707.
28. Freitas A de. A comparison of the radiographic and prosthetic measurement of the sagittal path movement of the mandibular condyle. *J Oral Surg* 1970;30:631-8
29. Owen EB. Condyle path: Its limited value in occlusion. *J Am Dent Assoc* 1948;36:284-90. 31.
30. Kumar JS, Gupta G, Bansal S, Gupta P. Variability and validity of the anterior point of reference": A cephalometric study. *Baba Farid Uni Dent J* 2011;2:107-11.