


2021, Volume 8, ID 488

Case Reports

DOI: [10.15342/ijms.2021.488](https://doi.org/10.15342/ijms.2021.488)

Determination of the Occlusal Plane in Complete Denture: About the Paterson Technic

Jihane El Aoud , Wijdane El Hawari , Nadia Merzouk, Faiza Benfdil

Department of Prosthodontic, Faculty of Dental Medicine, University Mohammed V , Rabat, Morocco.

ABSTRACT

The rehabilitation by complete removable denture is commonly used for edentulous patients. The respect of operating procedures represents the main condition for therapeutic success. Among these procedures, the occlusal plane's determination and orientation remain an essential step to respect minutely.

Indeed, it is one of the most critical stages for obtaining an optimal smile esthetic, facial harmony, and improving oral functions. Many authors reported various technics: anatomical, radiographic, and physiologic methods such as piezography and Paterson technic. This later consists of the determination of the individualized occlusal plane according to the registration of physiological movements.

In this context, we will describe the Paterson method via a case report and discuss its feasibility, clinical effectiveness, and advantages compared to other technics.

Keywords: Occlusal Plane, Complete Denture, Edentulous Jaw, Occlusal Registration Material.

Received: 29 Mar 2021; Revised: 23 Sept 2021; Accepted: 27 Sept 2021; Published: 02 Oct 2021

Correspondence: Jihane El Aoud, Department of Prosthodontic, Faculty of Dental Medicine, University Mohammed V, Rabat, Morocco. Email: jihaneelaoud92@gmail.com

Cite this article as: El Aoud J, El Hawari W, Merzouk N, Benfdil F. Determination of the Occlusal Plane in Complete Denture: About the Paterson Technic. Integr J Med Sci. 2021;8:488. [\[https://doi.org/10.15342/ijms.2021.488\]](https://doi.org/10.15342/ijms.2021.488).

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INTRODUCTION

The determination of the occlusal plane (OP) constitutes the foremost step in prosthetic rehabilitation. Indeed, it allows the practitioner to define the situation adequately and the orientation of the prosthetic tooth.

Many authors have defined this plane. We cite some of them:

According to Thomas and Coll, [1] it is «an imaginary plane touching the incisal edges of the lower incisors and the canines and the distobuccally cusp of the lower second molar.»

As for Ramtjord and Coll, [1] it can be defined as «an imaginary curved surface that touches the incisal edges of the incisors and tips of occluding surfaces of the posterior teeth.»

Fenn and Coll [1] have defined the extension of this plan from the mesio-incisal angle of the upper central incisor to the mesio-palatal cusp of the first maxillary molar.

Klein, since 1970, has developed an impression technic called piezography. Its principle was to model muscular activity by using a plastic material. This technic allows a determination of an «equilibrium zone» in which the prosthesis must be made to obtain maximum stability

and propose an occlusion plan. Indeed, this concept offers the determination of the occlusal plan situated on the upper limit of the mandibular prosthetic corridor.

This corridor corresponds to the most convex part of the tongue; this technique is allowed by pronouncing the phoneme «SIS.»

The Paterson method is based on the physiological and functional registration of the occlusal plane to obtain an individualized plan of the patient. Indeed, this method involves the patient by carrying out mandibular movement (lateral and protrusion). For this reason, specific bases were used containing resin bases and abrasive material (a mixture of plaster 50% and carborundum 50%). This technic was described firstly and changed secondly by PATERSON. This modification was to avoid the risk of mandibular protrusion by using an articulator (Haller) and the technic of Wadsworth (flag technic).

Can this technic provide an easy and practical method to determine an occlusal plane, and will it ensure esthetic and functional occlusion requirements?

We will try to answer this question through the discussion of a case treated by this technic. The objective of the present article is to update «an old technic» which is called: Paterson method, and to analyze how applicable it can be.

CASE REPORT

A 56 older man was received at the prosthodontic service at the dental consultation and treatment center in Rabat (Morocco) to replace his inadequate prosthesis (unaesthetic smile and instability problem).

Facial analysis revealed an overvalued vertical dimension of occlusion (VDO), a slight mandibular deviation towards the right side, and a convex profile (class II according to BALLARD).

An intraoral examination revealed completely edentulous maxillary and mandibular arches. The osteomucosal support is favorable (class II of ATWOOD). Undercuts at the buccal level of the maxilla were observed, and the linguistic areas and the mandibular vestibule were deep enough.

Examination of the prostheses occlusion revealed that the contacts were poorly distributed, and there was a mandibular protrusion.

PROCEDURE

- The classic clinical steps of complete denture: primary impression and secondary impression were carried out;
- Intermaxillary relation was done after adjusting the upper occlusion plan, at the anterior level concerning the bi-pupillary plane, the vertical position of the anterior base (2 mm from the superior lip), and at the posterior level concerning the camper plane. Then the adjustment of the mandibular occlusion was made respecting the correct vertical dimension of occlusion and the centered maxillary relation. The two models were transferred to an articulator.
- We determined the occlusal plane by the physiologic Paterson technic. We made specific bases of intermaxillary relation record comprising resin bases and abrasive material (a mixture of plaster 50% and carborundum 50%) and an anterior wedge which is vital for the conservation of the VDO already predetermined.

Firstly, the two bases are oversized by 2 mm. Then an adhesive is applied to the underside of the bases before their insertion. The patient is then invited to perform lateral movements and propulsion until the two anterior resin wedges contact.

The patient regularly stops to rinse the mouth, continuing until the adequate vertical dimension is reached.

Using the articulator, the angles of Bennet and condylar slopes were adjusted by recording bases.

The mounting of a prosthetic tooth was performed according to the recorded occlusal surface which the patient modeled. Then we verify the static and dynamic occlusion. Finally, the polymerization of the prostheses was carried out. Arriving at the step of prosthetic Restauration, we were satisfied that there were excellent occlusion contacts. Indeed, it was well distributed and generalized. The concept of balanced occlusion was respected.

The patient was satisfied by the result, and control sessions were scheduled.

DISCUSSION

Orientation of the occlusal plane has always represented a challenge for a prosthodontist. Various techniques have been described to orient this curve, such as anatomical landmarks, cephalometric and physiologic methods. We note different approaches suggested by the following authors:

Lundquist and Luther [2] found that the positioning of the occlusal plane would pass through the lateral commissures of the lips. The current study demonstrates that laypeople prefer symmetrical faces with a commissure line parallel to the interpupillary line and transverse occlusal plane [3].

According to Pound and Coll, the posterior extension of the occlusal plane would pass through the centers of the retromolar pads [4]. It should be positioned with second molars at the level of the upper third of the retromolar pad, as stated by Ismail and Coll [5].

Nagle & Sears, in 1962, concluded that the occlusal plane should be parallel to and midway between the residual ridges.

Regarding the spatial position of the virtual line of the occlusal plane, Le Joyeux 1967 had located this plane parallel with the resting upper lip and parallel with the Camper line [6].

In the report of Landa, and Yasaki [7], they suggested that the occlusal plane should be parallel with the lateral border of the tongue.

Orientation of the occlusal plane in complete denture construction plays a dominant role in esthetic and phonetic functions. Pound Kattach and Coll [8] have found that the direction of the OP has an essential role in the perception of an esthetic smile.

The accurate positioning of the occlusal plane is also important for correct denture function [9]; there is a mutual relationship between teeth, jaws, masticatory muscles, and the temporomandibular joint (TMJ). This relationship was studied by Stumazaki and found mutual concordance among muscle, occlusal plane slope, and vertebral column changes.

Loi and others have reported a relationship between osteoarthritis of TMJ, the angle of the occlusal plane, and the position of the heads [10]. A harmonious occlusal plane facilitates natural mandibular movement and mastication [11].

Ogawa and Coll [12] have found that occlusal plane and occlusal guidance had a functional role and should be considered in restorative treatment.

Concerning the Paterson method, it was elaborated in 1923, based on the physiological and functional registration of the occlusal plane. It aimed to improve the registration predetermined. Paterson used two bases adjusted respecting physiologic and esthetic settings. The registration of intermaxillary records with waxes was undertaken.

After removing the excess wax, he realized two grooves on the low base, which had received a mixture of plaster and carborundum powder.

The patient was invited to move to obtain curves approximatively similar to their natural curves. He transferred to the articulator (simple hinge type), and however, the mandibular protrusion was unavoidable.

For this reason, Paterson, in 1927 has modified his technic. This modification aimed to reduce the protrusion using a Wadsworth method (A geometric technic to determine the OP according to the Monson sphere).

Other authors have exploited this method; as was stated by Tamayo in 1963, this technic leads to a balanced occlusion. For Pompignoli, the bases were asymmetrical, the abrasion surfaces did not have a tendency to repetitiveness, and mandibular proglissement was found [13].

This technic has been updated by Professor Lesourd in the prosthodontic service at the dental consultation and treatment center in Rabat, as we have shown in the clinical case above. It consists to orient initially the occlusion plane parallel with camper reference.

Koller 1992 has concluded that it was impossible to adjust the OP perfectly parallel to the camper plane. It should be paralleled to a plane running from the subnasion to a point in the inferior portion and not to the middle of the tragus [14].

Fernand found that the Camper's plan was inconstant, and he recommended the piezographic technic as a first alternative, a functional and a straightforward method. If the patient already had the teleradiography, he could use the association of the piezographic plan and the teleradiography to confirm the Ricketts plan.

The laboratory setting of the model with the Cooperman plan can also be a good approach if we don't use the piezography and teleradiography technic [15].

S. Subhas et al. concluded that the middle ala-tragal line could be used as a reference for the mesocephalic head form and the superior ala-tragal line for the dolichocephalic brachycephalic head form as a reference to establish the occlusal plane [16].

On the technic described above, the transfer and reproduction of the intermaxillary relationship in the correct vertical dimension of occlusion and centric relation were done by using a semi-adjustable articulator.

According to Yuko Shigeta and Coll, the inclination of the occlusal plane is influenced by age, lost teeth, prosthodontic treatment, and mandibular morphologic [17].

This modified method avoids the risk of mandibular protrusion because both bases obtained by Paterson technic will be delivered on secondary models preliminary transferred to a correct vertical dimension and centered relation. The step of mounting teeth respects the curves formed by the lateral excursion and propulsion carried out by the patient.

The Wilson curve (in the transverse direction) and the curve of Spee (in the sagittal) were obtained systematically by this technic. These curves were described by many authors as an ideal tooth arrangement and permit a reasonable degree of stability during excursive chewing [18,19].

As for our clinical case, we noticed that on the phase of prosthetic insertion, the contacts were generalized and well distributed, the occlusion was stable, and the patient demonstrated an exciting satisfaction. We suggest that this method might be effective for determining the occlusal plane and improve good results. Moreover, the implication of the patient for occlusal plane achievement lead to physiologic intermaxillary relation and thus a maximum comfort,

We cannot generalize this outcome. More studies (randomized clinical trials) are necessary to objectify the interests of this technic and the causal link between this physiologic method and occlusal adjustments.



Figure 1: Transfert of intermaxillary relationship.



Figure 2: View of the models in the articulator: a gap on anterior part.



Figure 3: Clinical determination of occlusal plan using Paterson technic.



Figure 4: Mounting of prosthodontic maxillary teeth according to Paterson occlusal plane, right anterior and left views.



Figure 5: The presence of balancing contact in left when producing right laterality.



Figure 6: View of balancing contact when the propulsion is carried out.



Figure 7: The presence of balancing contact in right when producing left laterality.

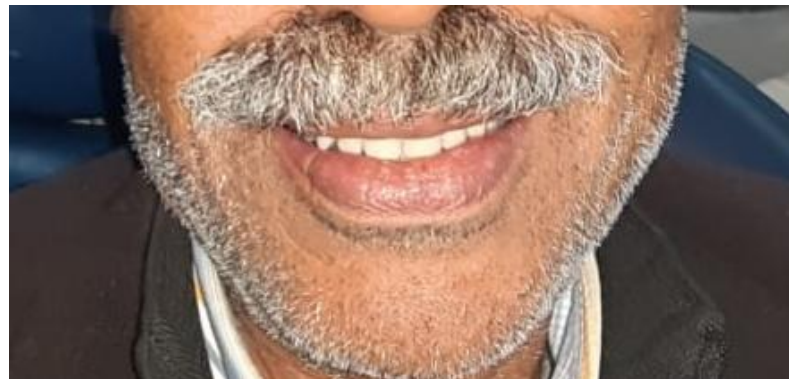


Figure 8: Patient smile with a new prosthesis.

CONCLUSION

According to our results, Paterson's technique of determining the occlusal plane is exciting and greatly facilitates the obtention of the balanced occlusion. It is a vital technic that improves comfort and respects physiological parameters.

Acknowledgments

None

Authors' contributions

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the [Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors](#). Indeed, all the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

Funding

No funding was received from any organization to conduct the present study.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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