SEVEN
publicações acadêmicas

OCCLUSAL PLANE LEVELING USING ORTHODONTIC MINI IMPLANTS

NIVELAMENTO DE PLANO OCLUSAL UTILIZANDO MINI-IMPLANTES ORTODÔNTICOS

NIVELACIÓN DEL PLANO OCLUSAL MEDIANTE MINIIMPLANTES DE ORTODONCIA

https://doi.org/10.56238/sevened2025.014-010

Mariana Lins da Fonseca Barretto Maia[1], Rafaella Vergetti Toledo[2], Débora Noêmia da Silva Farias[3], Emylee Carolyne Barbosa Silva Macário[4], Vyctor Cancio Balbino[5], Hugo Rafael de Souza Cavalcante[6], Raphaela Farias Rodrigues[7], Arthur Barros da Silva[8], Bruno Alves de Santana[9], Ruzielle Maria Silva de Moura[10], Victoria Ester Ximenes Machado[11], Hibernon Lopes Filho[12]

ABSTRACT

A tilted occlusal plane is the cause of an unpleasant smile, but it also represents a challenge due to the complex orthodontic procedures associated with its treatment. Skeletal anchorage allows for effective treatment of this asymmetry in most cases, with less dependence on patient cooperation and less need for orthognathic surgery. Mini-implants are an excellent choice for correcting the inclined occlusal plane as they guarantee effective bone anchorage as it is a simple and minimally invasive technique that does not affect facial aesthetics. Given this premise, this article aims to discuss the main aspects related to the diagnosis of occlusal plane inclination, treatment options and orthodontic mechanics of skeletal anchorage via mini- implants. Important details related to orthodontic mechanics for correcting the occlusal plane will also be presented, avoiding side effects and successfully achieving treatment goals and long-term stability.

[1] Post-graduate degree in Orthodontics. Centro Universitário CESMAC. Alagoas, Brazil.
E-mail: marianaangeiras@hotmail.com
[2] Post-graduate degree in Orthodontics. Centro Universitário CESMAC. Alagoas, Brazil.
E-mail: rafavergetti@hotmail.com
[3] Post-graduate degree in Orthodontics. Centro Universitário CESMAC. Alagoas, Brazil.
E-mail: deboranoemia@hotmail.com
[4] Graduated in Dentistry. Centro Universitário Tiradentes (UNIT). Alagoas, Brazil.
E-mail: emyleemacario@gmail.com
[5] Graduated in Dentistry. Centro Universitário Tiradentes (UNIT). Alagoas, Brazil.
E-mail: vyctorcancio@gmail.com
[6] Graduated in Dentistry. Centro Universitário Tiradentes (UNIT). Alagoas, Brazil.
E-mail: drhugocavalcante@gmail.com
[7] Dr. in Dentistry. Universidade Federal de Alagoas (FOUFAL). Alagoas, Brazil.
E-mail: raphaelarodriguesf@gmail.com
[8] Graduated in Dentistry. Centro Universitário Tiradentes (UNIT). Alagoas, Brazil.
E-mail: arthurbarrosdas@gmail.com
[9] Graduated in Dentistry. Centro Universitário Tiradentes (UNIT). Alagoas, Brazil.
E-mail: brunoalves-santana@hotmail.com
[10] Graduated in Dentistry. Centro Universitário Tiradentes (UNIT). Alagoas, Brazil.
E-mail: ruziellemaria@hotmail.com
[11] Graduated in Dentistry. Centro Universitário Tiradentes (UNIT). Alagoas, Brazil.
E-mail: victoriaexm@hotmail.com
[12] Dr. in Orthodontics. Centro Universitário CESMAC. Alagoas, Brazil.
E-mail: hibernonlopes@hotmail.com

Keywords: Skeletal Anchorage. Inclined Occlusal Plane. Mini-Implants.

RESUMO
Um plano oclusal inclinado é a causa de um sorriso desagradável, mas também representa um desafio devido aos complexos procedimentos ortodônticos associados ao seu tratamento. A ancoragem esquelética permite o tratamento eficaz dessa assimetria na maioria dos casos, com menor dependência da cooperação do paciente e menor necessidade de cirurgia ortognática. Os mini-implantes são uma excelente escolha para correção do plano oclusal inclinado pois garantem uma ancoragem óssea eficaz por ser uma técnica simples e minimamente invasiva não afetando a estética facial. Frente a essa premissa este artigo tem como objetivo discutir os principais aspectos relacionados ao diagnóstico da inclinação do plano oclusal, opções de tratamento e mecânica ortodôntica de ancoragem esquelética via mini-implantes. Também serão apresentados detalhes importantes relacionados à mecânica ortodôntica para correção do plano oclusal, evitando efeitos colaterais e atingindo com sucesso os objetivos do tratamento e estabilidade a longo prazo.

Palavras-chave: Ancoragem Esquelética. Plano Oclusal Inclinado. Mini-Implantes.

RESUMEN
Un plano oclusal inclinado es la causa de una sonrisa desagradable, pero también representa un desafío debido a los complejos procedimientos de ortodoncia asociados a su tratamiento. El anclaje esquelético permite un tratamiento eficaz de esta asimetría en la mayoría de los casos, con menor dependencia de la cooperación del paciente y menor necesidad de cirugía ortognática. Los miniimplantes son una excelente opción para corregir el plano oclusal inclinado ya que aseguran un anclaje óseo efectivo al ser una técnica sencilla y mínimamente invasiva que no afecta la estética facial. Dada esta premisa, este artículo tiene como objetivo discutir los principales aspectos relacionados con el diagnóstico de la inclinación del plano oclusal, las opciones de tratamiento y la mecánica ortodóncica del anclaje esquelético mediante miniimplantes. También se presentarán detalles importantes relacionados con la mecánica de ortodoncia para corregir el plano oclusal, evitar efectos secundarios y lograr con éxito los objetivos del tratamiento y la estabilidad a largo plazo.

Palabras clave: Anclaje Esquelético. Plano Oclusal Inclinado. Mini-Implantes.

1 INTRODUCTION

The inclination of the occlusal plane may be a result of skeletal asymmetry of the jaw bones or the asymmetrical vertical position of the anterior or posterior teeth. Before the advent of skeletal anchorage in orthodontics, correction of occlusal plane tilt had only limited indications, whether the origin was skeletal or dental (CORTE et al, 2015).

Therefore, surgery was considered the only method to correct this problem. However, skeletal anchorage made it possible for the molars to truly intrusion, which was difficult with conventional orthodontic means. In addition, it is now possible to correct the inclination of the occlusal plane by controlling the vertical position of the molars (SODAGAR et al, 2014).

In some patients with vertical asymmetry of the right and left posterior teeth without inclination of the anterior occlusal plane, occlusal inclination becomes obvious after orthodontic leveling. Facial asymmetry that is too minimal for orthognathic surgery, but which accompanies recognizable occlusal inclination, can be corrected by orthodontic treatment reinforced with skeletal anchorage. However, few biomechanical systems use it for this correction (LIMA JÚNIOR et al, 2022).

Traditionally, treatment options for asymmetries in the occlusal plane have been considered major challenges for orthodontists. Despite the complexity of the procedures, surgical approaches have always been considered a good option, as they have a reduced treatment time and avoid some adverse effects of conventional orthodontic mechanics. However, most patients refuse orthognathic surgery and treatment should therefore focus on orthodontic camouflage (FARRET, 2019).

One option is the use of the unilateral bite block, which is another treatment alternative and can cause a small intrusion on the side where it is located and a more significant extrusion on the other side. The limitation of this treatment modality is that it is not moderate to high intrusion movements can be achieved with these devices, in addition to the possibility of developing temporomandibular disorders after long periods of use. Another option is to use an asymmetric high-traction AEB; however, it depends on patient compliance and has limited results even after long periods of use (FARRET, 2019).

Skeletal anchorage emerged a few years ago as an excellent alternative for the treatment of asymmetries. They have no adverse effects on mechanics and do not depend on patient compliance, which means that the treatment is more predictable and reliable. Specifically for inclination of the occlusal plane, mini-implants may be the preferred option for cases of small discrepancies and two mini-implants should preferably be used to increase

retention, for these reasons, they may be a better option for the treatment of vertical asymmetries in the occlusal plane, providing excellent intrusion capacity of a group of teeth without risk of contact with any of the roots during treatment (OLIVARES et al, 2013).

The present article aims to analyze the diagnosis of occlusal plane tilt and its correction by means of mini-implants, thus reporting a case study demonstrating the orthodontic mechanics used for leveling in order to successfully achieve the treatment objectives and its long-term stability.

2 CASE REPORT

A 25-year-old female patient, L.S.S., arrived at the clinic of the CESMAC Orthodontics specialization course, complaining that after two years of previous orthodontic treatment, she realized that "her bite had stalled and her smile was crooked". In the health history, he did not mention important systemic alterations.

In the serious frontal extraoral examination (Fig. 1A), the facial thirds were proportional and did not present mandibular asymmetry, whereas in the frontal smiling (Fig. 1B) there was a very evident and aesthetically unfavorable inclination in the occlusal plane.

On intraoral clinical examination, the patient presented with partially assembled orthodontic appliances, class II malocclusion, left subdivision, with lower midline deviation on the left side, and a Brodie bite on the right side. In habitual occlusion, it was possible to observe an inclination of the lower occlusal plane.

Panoramic radiography and lateral teleradiography before the first treatment (Fig 3) show that the patient did not have a skeletal or dental problem, and that the previous orthodontic treatment was responsible for the deviation from the patient's occlusal plane.

The treatment plan consisted of correcting the deviation of the occlusal plane without surgery, only with orthodontic treatment, as well as promoting the uncrossing of the brodie bite on the right side, making the midlines coincide and leaving the right canine relationship in class I.

Initially, the assembly of the device was completed, which was partially installed. A Straight-Wire device was used, a Morelli device with a Rooth prescription.

The arches were aligned and leveled with 0.014-in nickel-titanium archwire, and 0.016-in nickel-titanium, 0.016-in steel, and 0.018-in steel archwires continued. Upon reaching the 0.018-in steel archwire, 4 mini-implants were installed in the lower right region with the objective of instructing this entire segment (Fig. 2). Thus, after the installation of the mini-

implants on the right side, the current elastics of the mini-implants were included up to the lingual buttons of 46 and 45, as well as to the arch in the region of elements 43 and 44 (Fig. 2).

In the following consultation, one more mini-implant (MI) was installed between 23 and 24 per vestibular to extrude the lower left side and thus help in the correction of the occlusal plane (Fig 4). Thus, the patient was asked to use 1/4 medium IM elastic in elements 33 and 34.

After 4 months of mechanics and activation of the elastics, the right side was uncrossed, correction of the occlusal plane, leaving only the top bite that remained in the region of 23. For this purpose, one more mini-implant was installed per palate and the patient was asked to use an elastic 1/4 medium of the MI to elements 33 and 34 (Fig 5).

The patient already reported a significant improvement in her smile (Fig. 6), abandoning the treatment and thus was unable to continue to finish the case.

Figure 1

Initial extraoral image of retreatment. A) Serious frontal without any asymmetry; and B) Frontal smiling showing the inclination of the occlusal plane

Figure 2

Intraoral image showing the mechanics of retreatment initiation with intrusion of the lower right side with mini implant

Figure 3

Panoramic radiography and lateral teleradiography before the first treatment

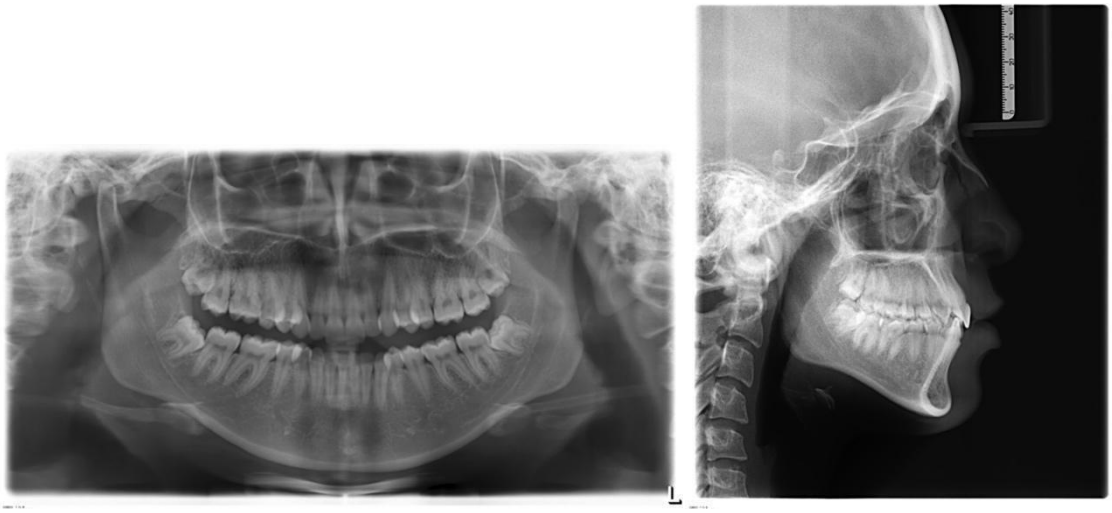

Figure 4

Intraoral image including another mini implant in the upper arch to extrude the left lower side along with the intrusion of the right lower side

Figure 5

After 4 months of mechanics, an improvement in the occlusal plane, and to finish, a mini implant per palate was included to finish correcting and uncrossing the left side

Figure 6

Frontal extraoral image smiling before and after retreatment with correction of the occlusal plane

3 DISCUSSION

According to research conducted by Villela et al, (2008), the need to provide absolute anchorage in orthodontics has led to the development and evolution of mini-implants, a perfect treatment alternative for correction of the inclined occlusal plane due to molar intrusion. Mini-implants are self-drilling pyramidal screws, with a slightly conical profile, which come in different heights, diameters and lengths. They are biocompatible, do not expand and are small to be placed in any area of the mouth. Mini-implants must withstand orthodontic loads (up to 300 g) in all planes of the space and can be placed and removed easily under local anesthesia after completion of biomechanical therapy.

According to Lima Júnior et al, (2023) it is necessary to perform a complete orthodontic diagnosis and select mini-implants with the correct length and diameter and orthodontic force distribution. A judicious combination of these factors can provide excellent results in the treatment of malocclusion, increasing anchorage, moving and controlling teeth and alveolar processes in three spatial planes.

However, several problems have been reported with its use, including high failure rates due to factors such as mini-implant diameter, gingival inflammation, implant site, or proximity of the device to the tooth root. The success of the implementation, on the other hand, depends on the design ideal, shape and size of the mini-implant, the angle of insertion and the size of the anatomical area where it will be inserted. Therefore, for this technology to be successful, several factors must be considered according to studies by Molina-Solana et al, (2013).

Usually, the upper arch is used as a reference for diagnosis, exposing the crown and gums, and the orthodontist must understand all the aesthetic precepts in the interpretation of the smile. Several features can be used to assess and how slope is established according to research conducted by Lima et al, (2022).

It was reported by Olivares et al, (2013), that photographs are the most traditional resources for the study of smile aesthetics, being important keys to diagnose asymmetries in the occlusal plane. First, one should capture a photograph of a spontaneous smile to show the maximum elevation of the upper lip. Photographing the smile during occlusion is part of regular orthodontic documentation and can be used to identify any deviation in the upper arch. In addition, another photograph can be captured, with a spontaneous smile and a slightly open mouth, to assess the lower arch and the parallelism of the curvature of the upper arch with the lower lip.

It was mentioned by Ciavarella et al, (2022) that in the upper dental arch, when the diagnosis shows that the teeth and gums on one side are well exposed and the gums on the other side are very exposed, that side must be intruded and then the opposite teeth of the lower dental arch are squeezed.

According to Farret (2019) after the intrusion into the upper dental arch, it must be held in place while the lower dental arch is extruded with vertical intermaxillary elastics, which are connected directly to the upper dental arch or occasionally to a bone anchoring device. In cases where the upper dental arch has 100% of the crown without gingival exposure on one side and less than 100% on the other side, intrusion should be avoided as it would reduce the exposure of the upper arch.

Also according to the same author mentioned above, he reports that in cases like these, the correction of the occlusal plane should start with an intrusion in the lower arch and reducing the exposure of the crowns of the upper arch on the same side. After the intrusion into the lower arch, it is stabilized and the patient is instructed to use a vertical elastic band on this side to cause compression of the upper arch.

When one side of the upper dental arch has no gum and has less than 100% of the crown, and the other side has the entire crown and excess gum, the choice should be a combination of intrusion of the side with excess gum and extrusion of the side with a lot of gum where the crown is not completely exposed. However, prior intrusion of the lower dental arch on this side. Therefore, in these cases, the correction of the inclination must start with the intrusion of both arcs, as analyzed by Farret (2019).

4 CONCLUSION

Vertical asymmetry has always represented a greater complexity in orthodontic treatment in adult patients. Often, in the case of small deviations, these asymmetries can be treated in a limited way using conventional mechanics, or have important side effects on the final result. In cases of moderate to severe deviation, combined orthognathic surgery is essential to obtain satisfactory results.

The use of skeletal anchorage in these cases can correct important asymmetries without side effects and reduce the need for orthognathic surgery. However, in these cases, it is necessary to make an accurate diagnosis and plan the position of the bone fixation device and the area of movement to correct the asymmetry. In addition, orthodontists must control

the negative effects of mechanics to avoid prolonging the time of orthodontic treatment and producing unsatisfactory results.

The inclined occlusal plane can be corrected with the use of mini-implants for molar intrusion, finally providing a less invasive option compared to orthognathic surgery and the risks it involves. In addition, it is an option for patients who do not have the economic conditions to pay for orthodontic-surgical treatment.

The use of mini-implants as a method of skeletal anchorage opens up a broader panorama in orthodontic biomechanics, since, as mentioned above, they can not only be used for molar intrusion, but also to perform movements that require high magnitude of force without compromising the adjacent force. teeth with secondary movements.

The success or failure of anchorage and the biomechanics of orthodontic treatment will depend primarily on the specialist, making patient cooperation less important.

REFERENCES

Araújo, T. M., Nascimento, M. H. A., Bezerra, F., & Sobral, M. C. (2006). Ancoragem esquelética em ortodontia com mini-implantes. Revista Dental Press de Ortodontia e Ortopedia Facial, 11(4), 126–156. https://doi.org/10.1590/S1415-54192006000400014

Ardani, I. G. A. W., Wicaksono, A., & Hamid, T. (2020). The occlusal plane inclination analysis for determining skeletal Class III malocclusion diagnosis. Clinical, Cosmetic and Investigational Dentistry, 12, 163–171. https://doi.org/10.2147/CCIDE.S248983

Cai, J., Min, Z., Deng, Y., Jing, D., & Zhao, Z. (2024). Assessing the impact of occlusal plane rotation on facial aesthetics in orthodontic treatment: A machine learning approach. BMC Oral Health, 24(1), 30. https://doi.org/10.1186/s12903-023-03817-y

Ciavarella, D., Lorusso, M., Palazzo, M. G., Fanelli, E., & Laurenziello, M. (2022). Occlusal plane modification in clear aligners treatment: A three-dimensional retrospective longitudinal study. Dentistry Journal, 11(1), 8. https://doi.org/10.3390/dj11010008

Corte, C. C. D., Silveira, B. L. D. A., & Marquezan, M. (2015). Influence of occlusal plane inclination and mandibular deviation on esthetics. Dental Press Journal of Orthodontics, 20(5), 50–57. https://doi.org/10.1590/2177-6709.20.5.050-057.oar

Farret, M. M. (2019). Occlusal plane canting: A treatment alternative using skeletal anchorage. Dental Press Journal of Orthodontics, 24(1), 88–105. https://doi.org/10.1590/2177-6709.24.1.088-105.sar

Jeon, Y. J., Kim, Y. H., Son, W. S., & Hans, M. G. (2006). Correction of a canted occlusal plane with miniscrews in a patient with facial asymmetry. American Journal of Orthodontics and Dentofacial Orthopedics, 130(2), 244–252. https://doi.org/10.1016/j.ajodo.2006.04.016

Lima Júnior, D. A., Dias, E. A. F., Fontenele, R. P., & Rodrigues, S. L. F. (2022). Clinical applications of orthodontic mini-implants: Literature review. Research, Society and Development, 11(13), e44111334948. https://doi.org/10.33448/rsd-v11i13.34948

Lima Júnior, D. A., Santos, A. M., Bezerra, F., & Sampaio, A. L. S. (2023). Uso dos mini-implantes em tratamentos ortodônticos. Brazilian Journal of Implantology and Health Sciences, 5(4), 1260–1279.

Mahmood, T. M. A. (2023). Occlusal plane steepness and profile change following TAD-based one-step retraction on four-unit extraction cases: A retrospective study. Diagnostics, 13(14), 2395. https://doi.org/10.3390/diagnostics13142395

Meng-Yun, Y., Chen, C., & Li, Q. (2021). Correction of maxillary occlusal plane deviation with the aid of miniscrew device. Modern Research in Dentistry, 6(4). https://doi.org/10.31031/MRD.2021.06.000642

Molina-Solana, R., López-Jarana, P., & Fernández-Palacín, A. (2013). Miniscrew appliances and their use in orthodontics. Open Journal of Stomatology, 3(1), 103–108. https://doi.org/10.4236/ojst.2013.31019

Olivares, A., Vicente, A., Jacobo, C., Molina, S. M., Rodríguez, A., & Bravo, L. A. (2013). Canting of the occlusal plane: Perceptions of dental professionals and laypersons. Medicina Oral, Patología Oral y Cirugía Bucal, 18(3), e516–e520. https://doi.org/10.4317/medoral.18437

Santos, A. M., Lima Júnior, D. A., Bezerra, F., & Sampaio, A. L. S. (2021). Mini-implantes facilitando a ancoragem ortodôntica. Brazilian Journal of Surgery and Clinical Research, 36(3), 23–27.

Shen, P., Xu, W. F., Ma, Z. G., Zhang, S. Y., & Zhang, Y. (2015). Case studies on local orthodontic traction by minis-implants before implant rehabilitation. International Journal of Clinical and Experimental Medicine, 8(5), 8178–8184.

Sodagar, A., Sobouti, F., & Shahsavari, N. (2014). Occlusal plane flattening by miniscrew in skeletal open bite: A case report. Caspian Journal of Dental Research, 3(1), 54–59.

Villela, H. M., Sampaio, A. L. S., & Bezerra, F. (2008). Utilização de microparafusos ortodônticos na correção de assimetrias. Revista Dental Press de Ortodontia e Ortopedia Facial, 13(5), 107–117. https://doi.org/10.1590/S1415-54192008000500012