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5-Point Protocol in All-on-4 surgical planning: an alternative to zygomatic implants

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Abstract

The rehabilitation of edentulous patients with severe maxillary atrophy has always represented a challenging frontier for implant dentistry. 3D imaging exams and surgical software have brought precision to procedures, enabling prior planning of implant anchorage sites. Good planning, based on widely accepted protocols, can provide more assertive procedures, with safe and long-lasting results. In this sense, this study aims to present a preliminary evaluation of the 5-Point Protocol for planning and executing oral rehabilitation of edentulous patients with maxillary atrophy, in the All-on-4 concept and with immediate loading. Methodologically, this is an exploratory study evaluating clinical cases, carried out over four years, aiming to gather the opinions of experts. As a result, it was found that the 5-Point Protocol aims to standardize the search for better implant anchorage structures, indicating sites with sufficient bone quantity to enable immediate loading. Of the five suggested points, four are in zone 2, representing an alternative to zygomatic implants. Experts conclude that the 5-Point Protocol offers more assertive planning for implant anchorage, supporting immediate load in oral rehabilitation procedures in the All-on-4 concept, reducing planning and surgery times, associated risks and providing another alternative for zygomatic implant surgery.

Highlights 1 - The 5-Point Protocol offers a structured approach to identifying optimal implant anchorage points in the All-on-4 concept, enhancing surgical precision and outcomes; 2 - This protocol simplifies surgical planning, reducing both planning and surgery times while improving the predictability of results in oral rehabilitation procedures; 3 - Four of the five suggested anchorage points are located in zone 2, providing a viable alternative to zygomatic implants and reducing associated surgical risks; 4 - The protocol emphasizes the importance of thorough assessment of bone quality and quantity, as well as careful selection of implant dimensions and angulation for successful immediate loading; 5 - Utilization of advanced imaging technologies and surgical planning software is crucial for the effective implementation of the 5-Point Protocol, ensuring safer and more predictable surgical outcomes.

1. Introduction

The rehabilitation treatment of edentulous patients with severe maxillary atrophy has always represented a challenging frontier for implant dentistry. The All-on-4 technique, introduced more than two decades ago, revolutionized implant dentistry by providing the opportunity to treat a significant portion of patients with atrophic maxillae, simplifying procedures and, thus, providing safety, agility and more affordable costs [1, 2].

While the conventional All-on-4 approach involves two anteriorly placed axial implants and two distally tilted implants, advances in technology and surgical techniques have opened new avenues to optimize implant placement and improve long-term results [3].

Jensen et al (2010) introduced the concept of tilting anterior and posterior implants, creating V- or M-shaped configurations to use structures with greater bone volume and density, such as the lateral piriform rim and nasomaxillary support. The point with the greatest volume and density was called the M-Point and changes its position.

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The arrival of advanced imaging technologies, such as cone beam computed tomography (CBCT) and surgical planning software, allowed dentists to perform a more accurate 3D assessment of each patient's anatomy, allowing for individualized treatment plans with unprecedented precision [3].

In addition, the introduction of extra-long implants facilitated new surgical approaches, such as trans-sinus techniques and Transnasal Implants®. These techniques use the superior bone density of the nasomaxillary buttress and conchal crest, respectively, to increase implant stability and support immediate load. Concomitantly with these surgical advances, prosthetic abutments with greater angulations emerged, allowing successful rehabilitation in positions of 30, 45, 52.5 or even 60 degrees [3, 4].

Thus, in modern implantology, surgical planning has become highly relevant in the patient's oral rehabilitation process. Good planning, based on 3D images (CBCT) and protocols, can provide more assertive procedures, with safe and long-lasting results [5].

In this sense, this article aims to present a preliminary evaluation carried out by experts on the 5-Point Protocol, proposed by Dr. Vanderlim Branco Camargo and colleagues.

2. Materials and Methods

From the point of view of the methodology adopted, this research is scientifically classified as exploratory, of the evaluative clinical study type, presented in the format of a scientific article. Studies of this type seek to present in detail results observed by researchers during repeated clinical practice. In addition to presenting the results achieved, this type of research aims to provide documentation and guidance for students and other professionals in the field [6].

Regarding the procedures, this study was carried out over four years, seeking to verify the opinion of two experts regarding the viability/functionality of the 5-Point Protocol in oral rehabilitation procedures for edentulous patients, using the All-on-4 concept with immediate loading.

Presented to colleagues in November 2020 by Dr. Vanderlim Branco Camargo, the 5-Point Protocol seeks, in short, to offer a more simplified surgical planning stage, enabling safer surgeries, in a shorter space of time and with more predictable results. The 5-Point Protocol also offers prosthetic fixation points in zone 2, enabling immediate loading in the All-on-4 concept, representing another option for zygomatic implants.

To make this study possible, in addition to the author, two specialist dentists monitored the planning steps in software and the creation of biomodels, observing the surgeries and the results obtained. At the end of four years, any advantages/disadvantages of the aforementioned protocol were discussed and presented, constitut-

ing the results of this study.

Anatomically, the protocol under analysis identified five main apical anchorage points, which are: Point 1 - Conchal Ridge Point: located within the nasal cavity, characterized by increased bone thickness and density; Point 2 - Pyriform Rim Point: located superiorly along the lateral margin of the pyriform aperture; Point 3 - Canine Point: located at the angle where the nasal floor meets the lateral nasal wall, superior to the apex of the canine; Point 4 - Lateral Incisor Point: located in the region of the lateral nasal base, superior to the apex of the lateral incisor; Point 5 - Vomer Point: located within the nasal cavity superior to the apex of the central incisor.

These points are meticulously evaluated in several tomographic planes (axial, coronal, sagittal, oblique, panoramic and 3D) to determine the most appropriate options for each individual case. A second best anchorage point is also identified for each implant position. Based on this analysis, the ideal implant length, diameter and angulation are determined. In some cases, the appropriate abutment type can also be selected during the planning phase.

It is important to note that, in addition to the anchor points, the team of experts considers other equally important factors in the search for the best result, such as the patient's health, aesthetic demands, prosthetic requirements, composite torque and anteroposterior distribution of the implant.

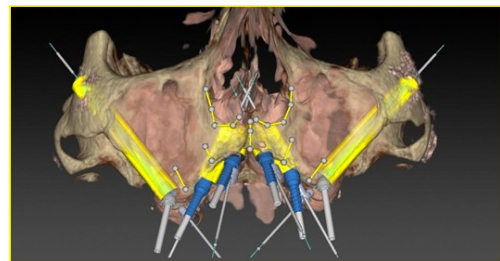


Figure 1. Implant location in DTX surgical planning software

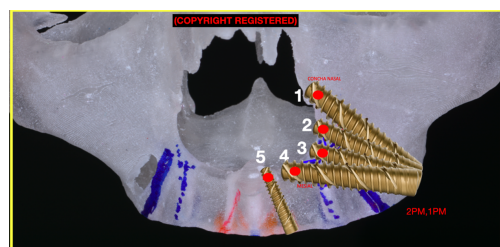


Figure 2. Arrangement of apical points in the 5-point protocol

3. Discussion and Results

Planning the rehabilitation of atrophic maxillae with immediate loading presents significant challenges in implant dentistry. Although the All-on-4 technique has

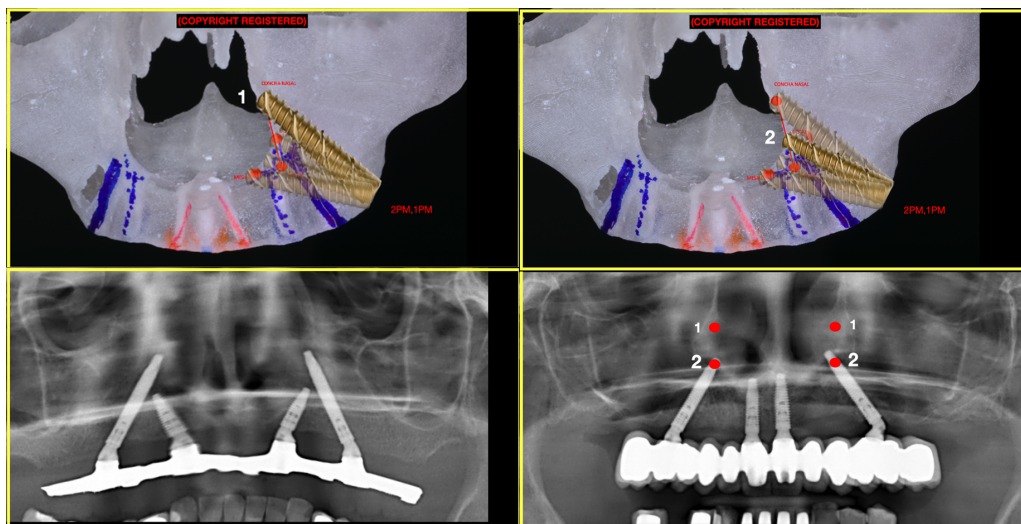


Figure 3. Arrangement of points 1 and 2 in the surgical planning and on the x-ray

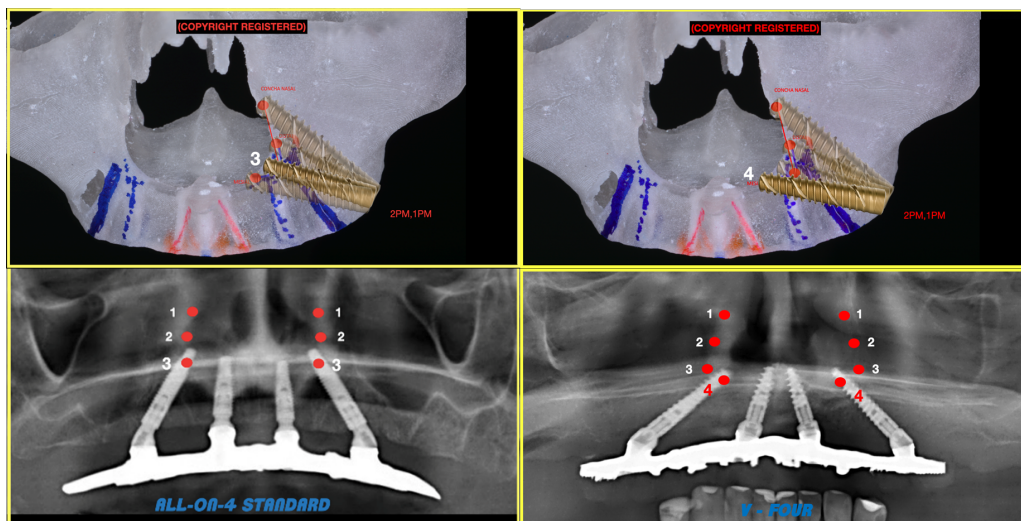


Figure 4. Arrangement of points 3 and 4 in the surgical planning and on the x-ray

become a standard approach, achieving predictable results requires a thorough understanding of the osseous anatomy, patient characteristics, and surgical techniques.

Initially, the All-on-4 concepts emphasized inclined implant placement to maximize bone engagement in areas of optimal density within the anterior maxilla (Zones 1 and 2). Jensen (2010) highlighted the importance of the "M-point," a region of high bone density within the fronto-canine buttress, emphasizing the need to fully utilize the available bone.

Our approach expands on these concepts by defining five primary anchorage points within the nasomaxillary buttress: Conchal Ridge Point, Piriform Rim Point, Canine Point, Lateral Incisor Point, and Vomer Point. This classification provides a protocol for surgical planning in the All-on-4 concept, aiding in the selection of optimal implant positions.

Balsalobre and Tepedino (2022) point to variations in bone density within the nasomaxillary support, with higher density typically found near the canine region (Point 3) and at the Conchal Crest Point (Point 1). This understanding, initially directed to rhinoplasty, made it possible to guide better positioning strategies for dental implants, maximizing bone engagement. [7]

The evolution of surgical techniques, including trans-sinus and Transnasal Implants® approaches, has significantly expanded treatment options. Early approaches often involved bone reduction to access the M-point. However, advancements in implant technology, such as the development of extra-long implants, have allowed clinicians to utilize higher-density bone structures, such as the Conchal Crest Point, as demonstrated by Vanderlim *et al.*, (2019). [5]

Several important considerations must be addressed for the successful implementation of this protocol: a) thorough assessment of bone quality and quantity, including assessment of cortical bone thickness and the presence of sufficient bone volume for implant placement; b) careful selection of implant length, diameter, and angulation, optimizing bone engagement and achieving adequate primary stability; c) choice of anchor points should be based on the individual patient's anatomy and treatment goals, considering factors such as bone quality, implant length, and desired prosthetic outcomes; and; d) surgical technique, including bone preparation and accurate implant placement. Adequate anteroposterior distribution (typically 12-15 mm) is essential for prosthetic stability and function.

The 5-Point Protocol, combined with advanced surgical techniques and meticulous planning, allows for successful rehabilitation in All-on-4 and trans-sinus procedures, even in severely atrophic maxillae, providing patients with functional and esthetic restorations. This is an advancement that promotes conceptual simplicity, a safer procedure and predictability of long-term results.

It was also observed in this study that the 5-Point Protocol presents itself as another alternative to be evaluated

before deciding on more complex procedures, such as surgery to install zygomatic implants. Except in specific cases (where the zygomatic implant is mandatory), the option for the 5-Point Protocol avoids the risks associated with zygomatic surgeries, such as exposure of spirals and sinusitis.

However, during the evaluation of the 5-Point Protocol, two limitations were observed that need to be clarified: the use of specific software and surgical skills. The protocol evaluated requires that the surgeon have full command of surgical planning software with 3D tomographic images (CBCT) and, as far as possible, that he simulate the procedure on bio-models. The second point concerns specialized surgical skills, experience and professional training.

Although the results observed by the researchers are quite encouraging, aligning similarly with the results of trans-sinus implants, long-term data are needed to consolidate the protocol and continually improve the technique.

4. Conclusion

The All-on-4 concept revolutionized implantology worldwide by enabling the rehabilitation of edentulous patients with a fixed prosthetic element for immediate loading. Over the years, technological advances have multiplied, providing new techniques, better materials and surgical alternatives. As a result, new procedures and protocols have emerged, making the surgical planning phase more important.

As seen in this study, the experts contact with the 5-Point Protocol has proven to be very promising. In essence, the 5-Point Protocol aims to simplify the search for safe anchorage points for implants in the All-on-4 concept, enabling the primary stability necessary for immediate loading in atrophic maxillae.

Thus, by strategically positioning the implants between the five predefined anchorage points within the nasomaxillary support, the researchers were able to observe the maximization of bone involvement and the significant reduction in the need for more complex procedures, such as zygomatic implant surgery. It was also found that the 5-Point Protocol reduces surgical planning time, as it optimizes 3D images indicating the best anchorage.

Although the 5-Point Protocol requires prior professional skill (mastery of 3D image planning software and surgical skills), the potential benefits are quite encouraging. Among the advantages found, the researchers reached a consensus on the following points: a) reduced planning time; b) reduced surgical procedure time; c) reduced procedure costs; d) long-term maintenance of hard and soft tissues; e) greater predictability and safety of results; and f) lower risk associated with surgical procedures. The clinical study concludes that the 5-Point Protocol is functional, recommending its use.

However, it is important to note that more research

is needed to evaluate the long-term clinical results of using the 5-Point Protocol, validating the preliminary analysis presented in this study. Continued advances in technology and surgical techniques are welcome and may, in the near future, ratify the results found here, enabling continued cost reduction and the rehabilitation of more patients.

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