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The Use of Technical "Standard All-on-Four" in the Maxilla

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Abstract

Among the factors that should be considered for the rehabilitation of atrophic jaws is mainly the anatomy of edentulous jaw, which offers trouble installing fixtures in view of the proximity to the maxillary sinus and nasal cavity. There are several possibilities to rehabilitate atrophic arcs, autogenous grafts, distraction osteogenesis, angled and short implants have been widely used in clinical practice. Thus, advanced surgical techniques are disclosed in the literature, such as the all-on-four standard technique. This technique consists of inserting four implants for a complete rehabilitation, and inclining a previously straight distal implant 45°, allowing anchorage in better bone (jaw previous zones), use of longer implants and decreasing the size of the prosthetic cantilever. The purpose of this literature review was to evaluate the scientific articles who observed the behavior of dental implants installed by the all-on-four technique in the maxilla. Initially, using the key words, 62 articles were obtained. After applying the inclusion criteria, 19 articles were selected. In each study the following were evaluated parameters: success rate of angled and axial implants, bone loss, and prosthetic complications. Finally, seven studies contemplated the requirements to be in this review. The literature of the art "all-on-four" standard in edentulous jaws showed that both angulated and axial implants have high success rate (92.8% to 99.3%) and similar bone loss. Therefore, the all-on-four standard technique is a viable option in the medium- and long-term for immediate fixed prosthetic rehabilitation in atrophic jaws.

Keywords

Dental Implants, Edentulous Jaw, Implants and Prostheses

Introduction

Ever since the first surgery done in 1965 by Branemark, dental implants have been widely used in oral rehabilitation. For more than 40 years, the method advocated by Branemark has undergone several modifications, both in its application and in its indications [1].

Some factors may be decisive for planning rehabilitation associated with dental implants. These include bone resorption due to unavailability of the alveolar processes, pneumatization of the maxillary sinuses, and superficiality of the foramen and mentoniano channel. These anatomical accidents associated with the quality and deficient bone quantity may limit or prevent the installation of implants, making them necessary procedures prior to the installation of fasteners.

Among the factors that should be considered for the rehabilitation of atrophic jaws is mainly the anatomy of edentulous jaw, which offers trouble installing fixtures in view of the proximity to the maxillary sinus and nasal cavity. On the other hand, in the maxilla there is generally thinner and less dense cortical bone trabeculae when compared to jaw, determining an initial instability of installed fasteners and low bone-titanium interface when these attachments are integrated [2,3].

There are several possibilities to rehabilitate atrophic arcs. Autogenous grafts can be performed for purposes of making bone and are very predictable increase in horizontal, but in case of gains in vertical, appear very limited. The distraction osteogenesis technique may be used in these cases, but the technique requires high cost, and appropriate apparatuses are associated with great discomfort for the patient [4]. The use of angled implants would be a good solution for multiple implants, but has limitations in cases of single implants [5]. The use of short implants has been a good option in these cases because they offer a number of advantages over those already mentioned, such as lower cost, reduced time of execution, simplicity, and lower risk of complications [6].

So the quest to solve these problems without the use of bone grafts and without delay in the completion of treatment, where possible, causes an increasingly growing demand for new techniques. Thus, advanced surgical techniques are disclosed in the literature, such as the All-on-four standard technique. This technique was described by Maló et al. [7], and consists of inserting four implants for a complete rehabilitation, and inclining a preciously straight distal implant 45°, allowing anchorage in better bone (jaw previous zones),use of longer implants and decreasing the size of the prosthetic cantilever.

The completion of the All-on-4 standard technique avoids the need for reconstructive surgery for bone gain, minimizing postoperative morbidity, time, and operating costs. However, there are too few scientific studies on the All-on-4 standard technique to prove the success of the technique in the long run.

Materials and Methods

This systematic review was performed using the following electronic databases: PubMed/Medline (NCBI), Web of Science (Thomson Reuters), the Cochrane Register of Controlled Clinical Trials (EBSCO), and Dentistry and Oral Sciences Source (DOSS; EBSCO), seeking articles related to the following terms: *fixed*

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prostheses all-on-four, *all on four maxilla*, *survival rate all on four*, *all on four dental implants, all on four dental rehabilitation, all on four implants, all on four concept, all on four implants*. The years surveyed were from 2000 to 2014. Articles were included that contained: the use of technical "standard all-on-four" in the maxilla, follow-up of at least one year after prosthesis in function, and studies evaluating the rate of successful implants and prostheses. Articles that were not evaluated included those discussing "hybrid All-on-4" and "All-on-4 zygomatic" techniques, those without data, and studies that did not allow comparison with other studies.

Initially, using the key words, 62 articles were obtained. After applying the inclusion criteria, 19 articles were selected. In each study, the following were evaluated parameters: success rate of angled and axial implants, bone loss, and prosthetic complications. Finally, seven studies contemplated the requirements to be in this review. The All-on-four system is well documented through clinical cases, though there are few large-population studies or randomized controlled trials.

Results

Seven studies were included, reporting a total of 1543 implants in 587 patients. Malo et al. [8] evaluated 32 patients (17 men and 15 women) with a mean age of 55 for one year. 128 implants were installed to rehabilitate atrophic jaws. Malo et al. [9] evaluated 23 patients (18 maxilla and 5 mandible), resulting in the installation of implants 92 and 72 implants in the maxilla and 20 in mandible. Pomares et al. [10] evaluated 20 patients (ages 36-68 years) rehabilitating 19 maxilla and 9 mandible. We used 127 implants to support the prosthesis immediately after the All-on-four or All-on-six technique. Malo et al. [3] rehabilitated 242 patients (101 men and 141 women, mean age = 55.4 years; range: 25-87 years). They were installed with 968 implants for rehabilitation of the jaws according to the all-on-four technique. Babbush et al. [11] rehabilitated 165 patients (72 men and 93 women) with a mean age of 59 (standard deviation (SD) 11 years). 708 implants were placed to rehabilitate both jaws (109 jaws and jaws 68, totaling 436 implants in the maxilla and 272 implants in the mandible). Twelve patients were treated in both jaws. Crespi et al. [12] evaluated 36 patients (22 women and 14 men) with a mean age of 54.6 years and rehabilitated 44 jaws (24 maxilla and 20 mandibles), total installation of 176 implants. Di Ping et al. [13] evaluated 69 patients (37 men and 32 women) with a mean age of 56.7 years (range: 37-74 years). A total of 86 arches, including 26 edentulous arches (10 maxilla and 16 mandible) and 60 arches toothed with terminal dentition (28 maxilla and 32 mandible) were treated according to the all-on-four technique resulting in the installation of 344 implants.

In the studies reviewed, the length of the implants ranged from 10 to 18 mm. It should be noted that the evidence of the results of this review are limited by the lack of homogeneity between studies, making it difficult to conduct a systematic review.

Discussion

Success rates of reviewed literature were 92.8% and 99.3% for implants in maxilla; statistically significant differences were found in both studies. Malo et al. [8] 32 rehabilitated patients with the "all-on-four" standard technique, the 128 implants immediately loaded with a fully fixed denture acrylic angled implants in only 3 different patients were lost, increasing a success rate of 97.6% for implants one year follow up. Another study [9], using a computerized surgical guide (CAD-CAM), evaluated 23 patients, rehabilitating 18 jaws according to the All-on-four technique, achieving a success rate for implants of 97.2% at 1-year follow-up. In another study [3], 242 rehabilitated patients with 968 installed implants lost only 19 after 5 years, increasing the success rate to 98% for implants. Pomares et al. [10] evaluated 20 patients with advanced periodontitis and rehabilitated a total of 19 jaws by using the All-on-four standard technique, unless otherwise they planned maxillary ceramic prosthesis with low bone quality (type III and IV). Thus, 9 jaws were rehabilitated and obtained a success rate of 96.7% for implants. Babbush et al. [11] evaluated 165 patients, rehabilitating 109 maxilla and achieved a success rate for implants of 99.3% after 27 months. Crespi et al. [12] had a success rate of 98.96% for maxilla implants. In this study, 24 jaws were rehabilitated with the "all-on-four" standard technique and of the 96 implants placed, only 1 angled implant was lost after 3 years, achieving a success rate of 100% for axial implants and 97.97% for angle implants. Di Ping et al. [13] obtained a success rate of 92.8% for implants after an average of 33.7 months of follow-up. This study evaluated 69 patients, rehabilitating 38 maxilla. Of the 152 implants placed, 11 implants were lost between the fourth and eighth weeks. The cases compared axial and angled implants do not present significant difference, which is in agreement with studies on biomechanical measurements, which showed that the tilted implants, when part of a prosthetic support, do not have a negative effect on the load distribution. In addition, logical biomechanical implants in the distal slope allow a reduction in the support arm length due to the posterior-most inclined position of the implants, resulting in more favorable stress distribution.

Bone loss was evaluated by five authors [3,8,9,12,13]. In the study by Maló et al [8], bone loss was considered according to changes in implant-abutment interface in periapical and panoramic radiographs after 1 year of follow-up, reaching an average of 0.9 (standard deviation (SD) 1 mm). Also, in 2007, Maló et al. [9] considered the changes in bone implant-abutment interface in panoramic and periapical radiographs and obtained a bone loss of 1.9 mm at 1 year follow-up. As in other studies, Maló et al. [3] evaluated bone loss considering the implant-abutment interface in periapical and panoramic radiographs, getting an average of 1.52 (standard deviation (SD) 0.3 mm) and 1.95 (standard deviation (SD) 12.44 mm) after 3 and 5 years of follow-up, respectively. Crespi et al. [12] compared the bone loss considering mesial and distal implant-abutment interface on panoramic radiographs after 3 years of follow-up, obtaining 1.10 (standard deviation (SD) 12.45 mm) for axial implants and 1.11 (standard deviation (SD) 0.32 mm) for angulated implants. There was no significant difference in 12, 24, and 36 months. Di et al. [13] also considered the mesial and distal marginal bone changes at the implant-abutment interface on panoramic radiographs to assess bone loss around the implants and obtained an average of 0.7 (standard deviation (SD) 0.2 mm) for axial implants and 0.8 (standard deviation (SD) 0.4 mm) for angulated implants after an average of 33.7 months of follow-up.

Many authors claimed prosthetic complications, however minimal, that were easily resolved [3,8,10-13]. Maló et al. [8] reported prosthesis fracture in 4 different patients, but all were bruxism. Pomares et al. [10] reported 8 cases of fracture of the provisional acrylic prosthesis and 7 cases of porcelain permanent prosthesis fractures. Maló et al. [3] reported 5 cases of fracture of the denture acrylic, 2 cases of abutment screw loss, and 1 case of loss of occlusal screw; all occurrences were in temporary prosthesis. Babbush et al. [11] reported that no prosthetic complications give a rate of 100% prosthetic survival after 27 months. Crespi et al. [12] reported only two cases of fracture of fully acrylic dentures and in 3% of cases loosening the occlusal screw after 6 months of follow-up. Di et al. [13] reported loosening the screw of the pillars in 3 prostheses, 5 cloves of stock dropping of the acrylic denture base, and 3 fractures of acrylic dentures.

Conclusion

The literature of the art "All-on-four" standard in maxilla showed that both angulated and axial implants have high success rate (92.8% to 99.3%). Therefore, the All-on-four standard technique is a viable option in the medium- and long-term for immediate fixed prosthetic rehabilitation in atrophic jaws.

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