

Research Article

Anatomical and Functional Considerations about Dental Implants. Part II: Risk Areas and Associated Complications

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Introduction: Oral rehabilitation with osseo-integrated implants requires integrated planning essential for successful treatment. There are some important anatomical aspects to be considered in relation to rehabilitation with implant systems.

Objective: To perform a literature review to describe important anatomical aspects to be considered in relation to oral rehabilitation with dental implants.

Methodology: The research was carried out in five databases (PubMed, Cochrane Library, Lilacs, Scielo, and Google Scholar) using the variation of the search terms "Anatomy" and "Dental implants", retrieving 1003 publications.

Results: After reading the titles and abstracts, 91 texts were conducted for full reading and 21 publications were considered for data extraction and article synthesis. Conclusion: the anatomical knowledge of the related areas, as well as the quality of bone tissue and biological aspects, is important for the Dental Surgeon to recover the aesthetics and functionality of the stomatognathic and phonetic system, providing a better quality of life to patients.

Keywords: Dental Implants; Biocompatible materials; Anatomy

Introduction

The rehabilitation treatment by means of osseo-integrated implants aims to preserve the integrity of the noble intraoral structures, recovering the aesthetics and functionality of the stomatognathic and phonetic system, allowing a better quality of life for patients [1].

Osseo-integrated implants started to be developed in 1956 and were clinically evaluated in the late 1960 [2]. Through a study of microcirculation with a titanium observation camera, inserted in rabbit tibias. The advent of bone-integrated implantology has caused, in the last thirty years, a dramatic change to the therapeutic possibilities of partially or totally edentulous patients, notable improvement in the results - not only functional, but also aesthetic and in the long-term prognosis of the results achieved [3].

However, there are some important anatomical aspects to be considered in relation to oral rehabilitation with implant systems [1]. Thus, the aim of this study was to describe important anatomical aspects to be considered in relation to oral rehabilitation with dental implants.

The maxillae are the most complex region for implant dentistry due to the functional and aesthetic aspects, as an aggravating factor the degree of gingival exposure and the harmony of the smile that the patient presents [4].

It is possible to notice in the anterior portion of the palatal region the presence of the incisor (or nasopalatine) channel that houses the nasopalatine vasculonervous bundle, from the nasal septum to the region of the pre-maxillary palatine mucosa, from canine to canine,

with the incisive papilla being the protection bundle gingival. It is important to observe the size of this canal because it often makes implant placement in the region of the central incisors unfeasible. This can be double, bilateral, or even triple, opening in the incisor fossa, whether this fossa is wide or not, reaching up to 11mm, with advancement to the vestibular bone plate [5,6].

The proximity of the anterior region of the maxilla to the nasal cavity is another limiting factor, as is the maxillary sinus in the posterior region. In cases of edentulous patients for prolonged periods, the resorption process is at an advanced stage, aggravated by the pneumatization of the maxillary sinus in the posterior region associated with a physiological resorption process [7].

Anteroposterior inclination in the region of the incisors and canines is an interesting anatomical aspect that makes implants to be inserted following this inclined direction of the maxilla and not perpendicular to the base of the residual alveolar ridge, as is usually done in the posterior region of the maxilla [4,8]. In a coronal section of the canine pillar region, it is possible to observe the existence of little spongy substance, the cortical bone almost completely dominates the region, making it a very favorable region for implant installation, even in atrophic maxillae [9,10]. However, the distribution of the implants as well as their diameter, length and type of surface are directly related to bone quality and quantities, as well as the prosthetic work to be performed on the implants. The vestibular bone plate is very thin in the anterior region [10].

In the maxillary tuber, a region of low bone density located in the posterior part of the maxilla, the distance between the trabeculae or

the size of the medullary spaces vary from 4 microns to 2mm. That is, the tuber is the region of lower bone density located posteriorly in the maxilla. This very thin cortical region makes it possible, using a alveolotome, to remove the cortical bone and obtain a larger amount of spongy bone, making this area an easy-to-access bone donor region [4,11].

It is necessary to consider some anatomical aspects and limiting factors of the mandible when planning for placing bone-integrated dental implants. One of these limiting factors is the mandibular canal that houses the inferior alveolar vasculonervous bundle and that emits its mental branches at the level of the second premolar [4]. The mental foramen remodels with bone resorption. It marks the division between the basal and alveolar bones and with the loss of bone stimulus, due to tooth loss, its upper wall collapses and is incorporated into the basal bone. With this, its opening turns towards the alveolar crest [12]. During an incision in the region, attention should be paid to avoid cutting and loss of function, as well as hemorrhage due to arterial injury [13].

A good identification of the distance from the alveolar crest to the roof of the mandibular canal is essential for the installation of implants in the region posterior to the mental foramen. This is because, even if there is no perforation of the canal roof, some patients report paresthesias related to the lower alveolar nerve due to reaming and the installation of implants close to the uppermost region of the mandibular canal. Even if these are temporary, they cause discomfort for both the surgeon and the patient [14].

The relationship between the buccal and lingual bone corticals of the alveolus shows the thinnest vestibular lamina for the anterior region, however, as it reaches the molar region, this relationship is reversed and the thickness in the lingual cortex is considerably greater [4]. The anterior region of the mandible is considered a safe area for the installation of dental implants. However, attention should be paid to the presence of the incisor canal [15]. The incisor canal, whose diameter varies from 1 to 2 mm, is completely corticalized in 21.7% of the cases and partially in 58.7% of the cases. This corticalization is more pronounced in its terminal part and close to the mental foramen. In 19.6%, it has no cortical walls and the neurovascular bundle passes through the medullary bone. The diameter of the incisor canal can play an important role in the success of osteo-integration [16]. In any case, it is recommended to evaluate the area by computed tomography exams prior to surgery.

Methodology

The research in five databases (PubMed, Cochrane Library, Lilacs, Scielo and Google Scholar) was carried out by two independent reviewers in order to describe important biological, anatomical and biomechanical aspects to be considered in relation to oral rehabilitation with implants dental. With the following eligibility criteria:

Inclusion criteria: 1) publications or books that describe anatomical aspects of the maxilla and mandible applied to implantology; 2) report complications in oral rehabilitation with bone-integrable implants; 3) Expose generalities of bone tissue, bone integration process and grafts.

Exclusion criteria: 1) publications where the terms applied anatomy and dental implants appear only in the authors' affiliation or in the references; 2) Publications that do not directly discuss the central objective of the topic.

The titles of all stored publications were read, and, when necessary, the summary, introduction and/or results and discussion sections were carefully investigated to ensure that the publications met the eligibility criteria. After the screening of the two independent reviewers, disagreements were discussed and resolved by consensus.

Results and Discussion

21 publications were selected to prepare the synthesis of this article after applying the selection method. Initially, duplicates were excluded (n=27), the electronic search procedure recovered 1003 publications. After reading the titles and abstracts, 912 were excluded (they did not directly discuss the central objective of the theme: n=332; the terms Anatomy and Implantology were only included in the authors' affiliation or in the publication references: n=580) and 91 texts were conducted for full reading.

From the selected publications, 10 (47.7%) original articles, 9 (42.9%) review articles, 1 (4.7%) book chapters and 1 (4.7%) Case report. Among the publications, laboratory work and clinical trials were the most found (17; 80.9%). General aspects about the anatomical-histological description of bone tissue and donor areas for grafts were also found (8; 38.0%). Another 7 (33.3%) publications reported the importance of anatomical knowledge of related areas and possible complications in oral rehabilitation with implants.

Oral rehabilitation with osseointegrated implants requires integrated planning essential for successful treatment. The repair of soft tissues using techniques of periodontal plastic surgery can lead to better aesthetics, function, hygiene and health of the peri-implant mucosa [17].

The satisfaction and success rate is high in relation to the procedure [18,19], however, as in any surgical procedure, there are some risks that can occur in the pre, trans and postoperative period, namely:

- The first risk is inflammation, presents symptoms such as pain, swelling, uncomfortable chewing, bleeding and even the formation of secretion in the implant region. The main factor is the formation of bacterial plaque (tartar), and the presence of plaque can lead to peri-implantitis (inflammation around the tissues of the implant), which originates from the lack of correct hygiene and thus to perform the correct hygiene it's essential.
- The second risk is the fracture of the implant, even though it is difficult to occur, just as the tooth can fracture, the implant can also, and the factors that can lead to this are the fit of the maladjusted bite (pathological occlusion), inadequate feeding, bruxism, and if this surgical impasse occurs, it is necessary to place a new implant.
- The third risk is paresthesia, which is the temporary or permanent numbness of some nerves of the face, this type of injury occurs during surgery and patients are very frightened by this risk that can be well controlled during the surgical procedure. With proper planning, exploring the information from CT scans to know

the exact location of the nerve and avoid getting close to it during the procedure. The most common exams are x-rays, but computed tomography is of great importance for the detailed precision of the procedure, another solution is computer-guided surgery, this method being able to make the surgery less invasive and enable the installing an implant more accurately and safely.

- The fourth risk is the probability of increased risk; therefore, there are risks that do not depend only on the professional or even on the materials used, but on the patient's commitment to the treatment, such as: Failure to clean the implants, habits of the day-to-day use of cigarettes and patients with chronic diseases [20,21].

Therefore, it is necessary to have a routine of care in relation to oral hygiene, healthy habits and regular monitoring of the dentist (routine consultations).

Conclusion

Therefore, the anatomical knowledge of the related areas, as well as the quality of bone tissue and anatomical aspects, is important for the Dental Surgeon who will develop in implantology and in advanced surgeries applied to the specialty in relation to oral rehabilitation, always avoiding risk areas and related complications.

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