Prevalence of short implants use in the jaws: a retrospective pilot study

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Introduction: *Implant placement has become the recommended treatment for rehabilitation of edentulous patients. Research in Implantology aims to develop rapid controlled procedures that provide patients and clinicians with greater comfort and predictability. In these circumstances, short implants were developed to replace conventional implant limited placement, thereby representing a feasible, simple and predictable alternative.* Material and methods: *To determine the prevalence of short implants use on a previously established sample of dental records, the latter were obtained from different dental offices and specialization courses between 2005 and 2012. The following was assessed: number of short implants (8.5-mm or 10-mm long), size of implants, the region where they were placed, as well as patients' sex and age.* Results: *Of the 82 dental records analyzed, 459 implants were obtained; the majority (79%) of them was placed in female patients, 48.6% were 10-mm long and 14.8% were 8.5-mm long. For both implant sizes, the most prevalent age group was between 50 and 59 years old.* Conclusion: *The use of short implants, when compared to the use of conventional long ones, increased in recent years due to new research. They are recommended in different circumstances and have proved to be a safe, predictable, less expensive technique without the need for multiple surgery, in addition to preserving patient's preexisting anatomic structures and being well received by patients and implant dentists.* Keywords: *Osseointegration. Dental implants. Prevalence.*

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INTRODUCTION

Oral implant rehabilitation to replace missing teeth is well-documented. Implants represent an effective alternative in the rehabilitation of partially and completely edentulous patients. Implantology success depends on proper implant activity which results from planning, surgical technique and a skillful prosthetic treatment.[1]

The literature discloses a significant number of prosthesis users of all ages, with patients reporting dissatisfaction with removable conventional dentures.[2] To prosthesis users of any age, implants function as a means to overcome lack of stability, difficult chewing and psychological insecurity.[3] Implant placement has become the treatment recommended to replace missing teeth.[4]

With the advent of Implantology, treatment conduct was modified and substantially reviewed. From this point of view, supporting bones must be assessed and bone tissue cannot be lost, so as to allow implant screws to be used and masticatory function to be restored. Once these concepts are clear, a second step would be to analyze the quantity and quality of bone support. Oftentimes, the maxilla, and/or mandible present with insufficient bone quantity, height or volume to accommodate an implant, which usually results from defects caused by trauma, disease, surgery, tooth extraction or physiological resorption.[5]

Dental implant treatment has become an alternative to traditional therapies, such as tooth-borne removable and fixed prostheses.[6,7] However, despite dental implant success, some restrictions have been imposed on its placement, particularly with regard to the quantity and quality of bone available, in terms of height and thickness.[6]

Reduced bone height or anatomical alterations, such as extensive maxillary sinus pneumatization and proximity with mandibular canals, often feature a limitation for the use of conventional implants. Grafting and bone regeneration surgical procedures as well as transposition of the inferior alveolar nerve are alternatives that facilitate treatment with conventional implants in these regions.[8,9]

In circumstances in which the use of conventional implants is limited, short implants could be chosen, as they represent a feasible, simple and predictable alternative.[8] Whenever possible and properly indicated, short implants prove to be a safe choice in the treatment of edentulous areas with limitations of bone height and volume.[6,7]

The pattern of bone loss after tooth extraction in the posterior region of the jaws varies widely. The maxilla has greater horizontal bone loss in the buccal-palatal direction and slow vertical loss; whereas in the mandible, bone loss primarily occurs in the vertical direction, often resulting in little bone height, but with a reasonable amount in the horizontal plane. As a result, and also due to the presence of noble anatomical areas, planning rehabilitation treatment of posterior atrophic

arches is usually more complex. The surgeon must consider previous surgical solutions for bone augmentation, or the use of angulated or short implants.[10]

Treatment of edentulous areas requires adequate bone availability at the receptor site, which is a problem in cases of atrophy that damages bone thickness and/or height available in the jaws.[11]

To overcome these physiological and anatomical limitations, several bone grafting techniques have been proposed. The type of graft is key to success because different types of biomaterial have different degrees of induction to osteogenesis.[1] There is no such thing as the ideal material for grafting, but autogenous bone is the gold standard in the literature, since its characteristics are nearly ideal.[12] Even though implant success can be achieved as a result of associating it with grafting techniques, the latter has high rejection rates due to the need for multiple surgical procedures, stronger postoperative sensitivity, high costs and increased treatment time.[1]

Another alternative to facilitate longer implants placement in the posterior mandible is nerve reposition; however, this surgical procedure implies increased risk of paresthesia.[1]

Several alternative therapies can be employed to allow rehabilitation with dental implants. High success rates with the use of short implants have been reported by clinical studies, which renders these implants a feasible alternative for cases of vertical bone atrophy.[4]

SHORT IMPLANTS

No consensus has been reached in the literature about which implants are considered as short. Such uncertainty is revealed by the various dimensions considered in scientific studies: implants varying from 4 to 10 mm in length. According to Renouard and Nisand,[14] the most appropriate definition of a short implant is a system of which intraosseous length is less than or equal to 8 mm, which therefore can be influenced by the surgical technique.[4,15] Santiago Júnior et al[1] claim that short implants are those implants with less than 10 mm in length.[1,7,16]

Changes in short implant body design and surface have been suggested to improve anchorage and better distribute occlusal load. Short implants have a disadvantage in terms of primary stability and distribution of forces, but their reduced length is counterbalanced with the addition of threads, which results in a substantial increase in bone-implant contact.[2]

With the advent of short implants, rehabilitation with dental implants in areas with reabsorbed ridges now constitutes a less complex, as well as less expensive and traumatic treatment option offered to patients. Whenever possible and properly indicated, short implants prove to be a safe choice in the treatment of edentulous areas with limitations of bone height and volume.[7]

Implants less than 10 mm in length used to be associated with high failure rates, since the first clinical results obtained with the use of short implants were not very promising. Over time, it was observed that the use of short implants with treated surface, larger diameters and increased primary stability results in higher success rates.[5]

Several articles published between 1991 and 2003 assessed the success rates of short implants and revealed a mean value of 85.3% *versus* 90% for long implants. These studies included several types of implants with different designs and surfaces. In comparison to long implants, short implants require less remaining bone, which decreases patient exposure to surgical procedures, such as bone grafting, sinus lifting or inferior alveolar nerve reposition, which constitutes a major advantage.[2]

As for effectiveness of short implants in surgical single or multiple prosthetic rehabilitation, the literature reports different success rates ranging from 55 to 100%. These differences may be assigned to variables that interfere in implant survival, such as the type of surface, the surgeon's learning curve, bone quality and quantity, primary stability, prosthetic protocol and lack of agreement on the concept of short implants.[4]

Thus, the present article aimed to assess the prevalence of short implants use compared to the use of conventional ones, the conditions in which short implants are indicated, the difficulties involved in implant placement and some biomechanical aspects, as well as the use of short implants in male and female patients of different ages.

MATERIAL AND METHODS

The study was conducted by analyzing dental records obtained from dental offices and specialization courses in Implantology in the city of Salvador, Bahia, Brazil. The study assessed the use of short implants and compared the findings with data obtained from the most recent literature.

Initially, a retrospective literature review was carried out on the use of short implants in the jaws, and some topics, such as biomechanical aspects, longevity and surgical-prosthetic planning, were discussed. The prevalence of short implants use in dental offices in the city of Salvador was also assessed considering: the number and size of implants, the region in which they were placed, as well as patients' sex and age.

Hence, this study aimed to describe the use of short implants in the day-to-day clinical practice, informing their prevalence by sex, age, size and type of implant, as well as the implantation region.

Records obtained in the last five years were used in the present study which assessed the prevalence of short implants use in a previously established number of records.

Although no consensus has been reached in the literature about the size

of short implants, this study considered implants not exceeding 10 mm in length. Initially, all implants that were 10 mm or less in length were considered; however, during a second implant selection, only those 8.5 mm or less long were considered while analyzing and discussing the clinical picture assessed.

Day-to-day clinical practice was taken into account, since most implant dentists no longer consider 10-mm implants as short implants.

RESULTS

A sample comprising 82 dental records was assessed. These data disclosed a total of 459 implants placed in different patients' mandibles and maxillae. Data were arranged in tables and separated by implant size (length ranging from 5 to 15 mm), implant type (short or long), quadrants, need for bone grafting, immediate loading, implantation immediately after extraction, the time of surgery, and implant loss.

Of all 82 dental records analyzed, 71 (86.5%) belonged to female patients; whereas only 11 (13.5%) records belonged to male ones. These 82 records provided a total of 459 implants, of which 362 (78.9%) were placed in female patients and only 97 (21.1%) in male ones (Figs 1 and 2).

Of 459 implants, 223 (48.6%) were short implants, that is, less than or equal to 10 mm in length. Individual assessment revealed that most short implants were 10 mm in length, totaling 135 (29.4%) implants. In view not only of lack of consensus in the literature, but also of the current clinical approaches, should smaller implants less than or equal to 8.5 mm in length be considered, this percentage would drop to approximately 68 (14.8%) implants. Implants longer than 10 mm (long) totaled 236 (51.4%); whereas implants longer than 8.5 mm totaled 391 (85.2%) (Figs 3, 4 and 5).

The prevalence of each implant size according to patients' sex was also assessed. Short implants prevailed among male patients, totaling 51%, with a higher number (25%) of 10-mm implants, while the number of long implants totaled 49% (Fig 6).

As for female patients, long implants prevailed, totaling 52%. Short implants totaled 48%, and the majority of them was represented by 10-mm implants, totaling 31%.

Assessment on short implants less than 10 mm and 8.5 mm in length, according to patients' age, revealed that, for both sizes and for both sexes, the age group with the highest prevalence of implant use was between 50 and 59 years old, with a total of 61% for implants less than or equal to 10 mm among male patients, 46% for implants less than or equal to 10 mm among female patients, 67% for implants less than or equal to 8.5 mm among male patients, and 47% for implants less than or equal to 8.5 mm among female patients (Figs 7-10).

DISCUSSION

Short dental implants were technologically developed to be used in areas with limited bone height. The use of these implants is justified to avoid the need for invasive surgical procedures and associate low morbidity, which, despite being well-documented, still face patient resistance as well as surgical complexity and moderate risk of resorption.[2]

No consensus was reached by the authors about the length of short implants. Most of them consider short implants to be less than 10 mm in length, but there are those who consider 8-mm implants as short ones.

Additionally, findings revealed that most records as well as the majority of implants were found among female patients, with

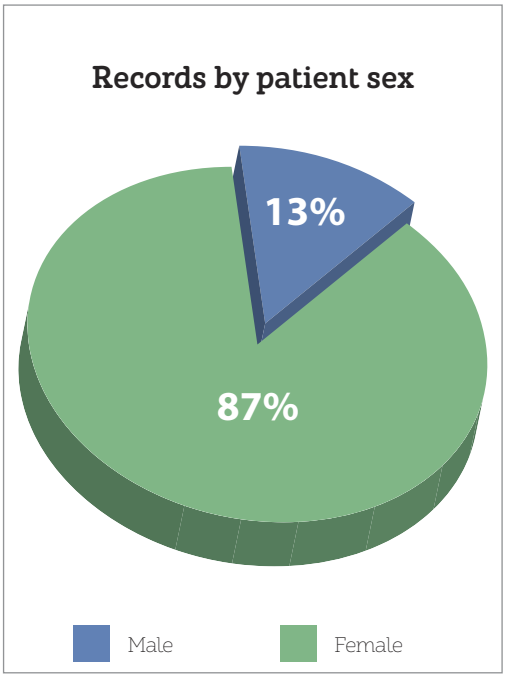

Figure 1. Total number of records by sex.

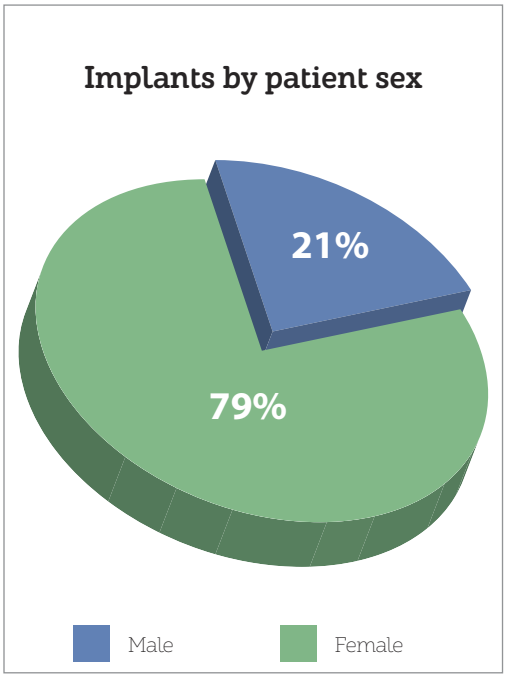

Figure 2. Total number of implants by sex.

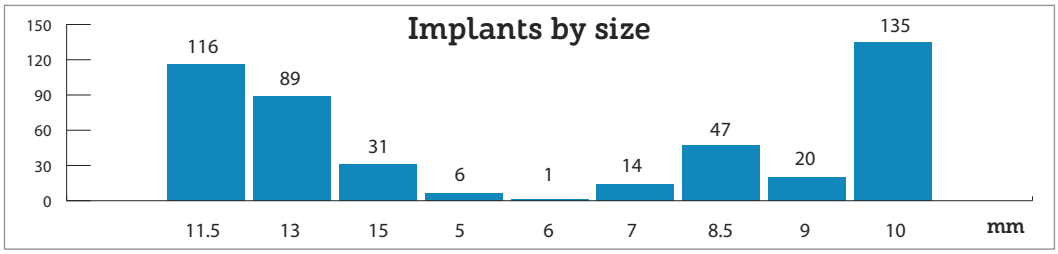

Figure 3. Total number of implants by size.

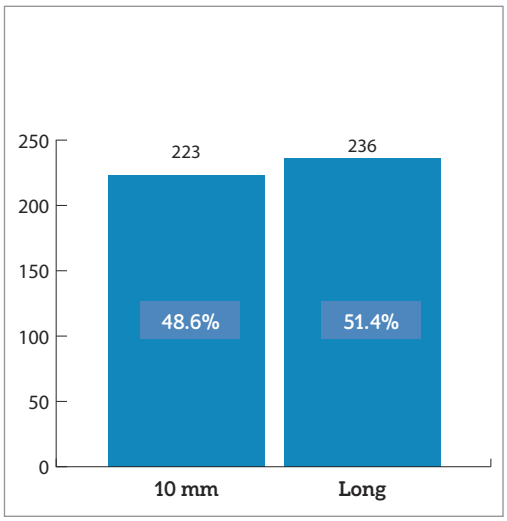

Figure 4. Total number of short implants with less than or equal to 10 mm, and long implants.

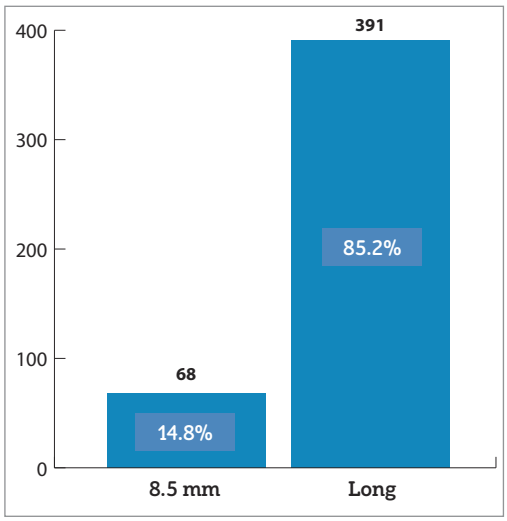

Figure 5. Total number of short implants with less than or equal to 8.5 mm, and long implants.

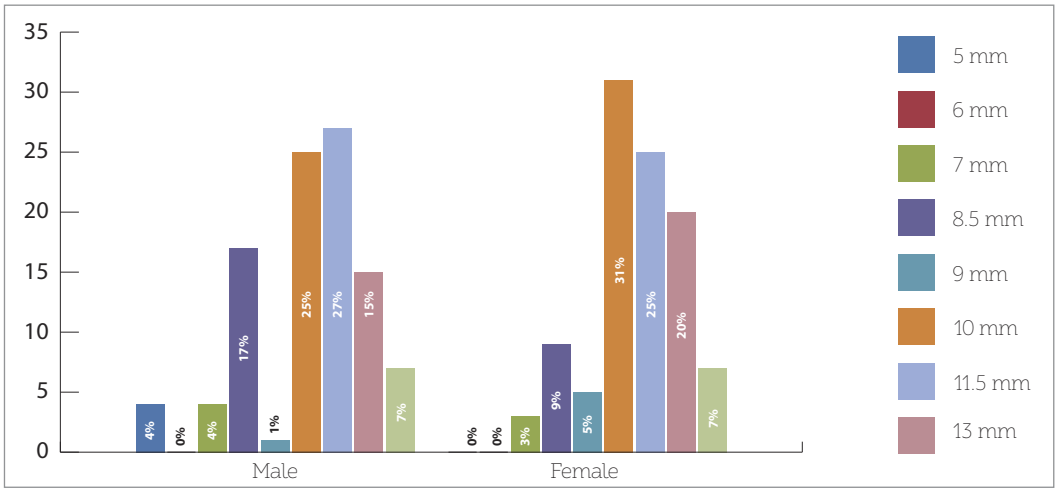

Figure 6. Percentage of the size of implants in male and female patients.

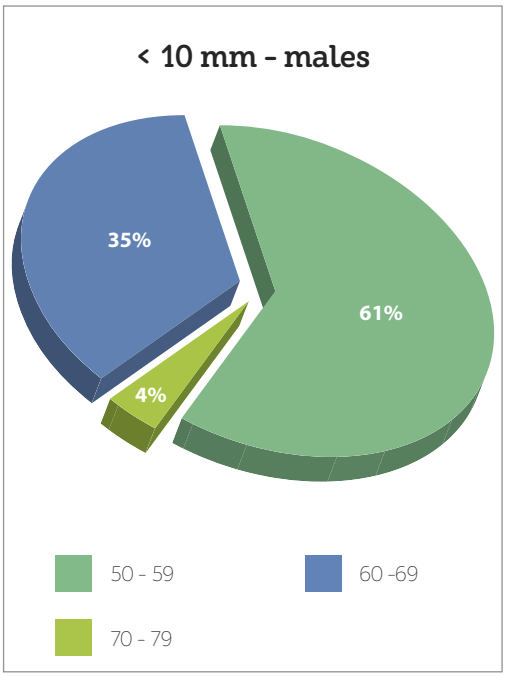

Figure 7. Percentage of implants less than 10 mm in length in males.

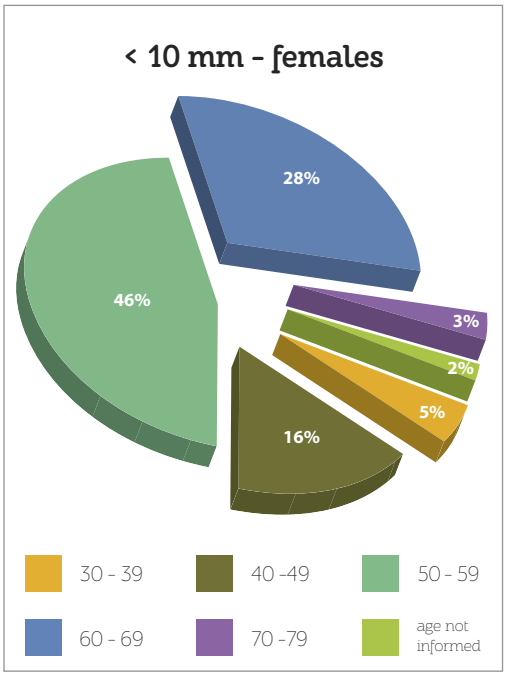

Figure 8. Percentage of implants less than 10 mm in females.

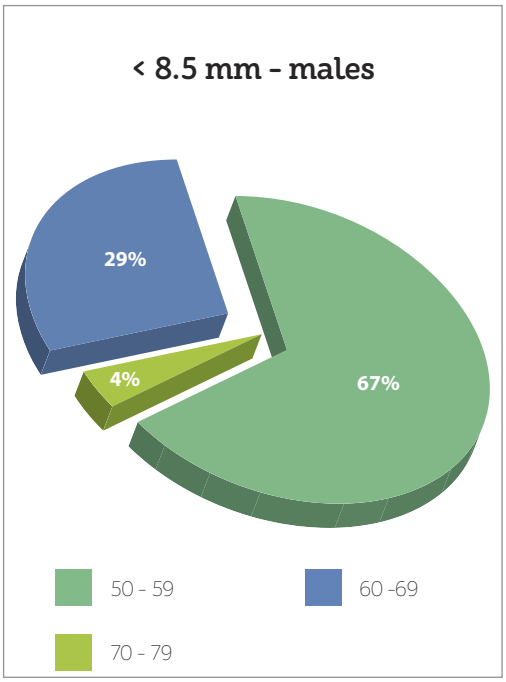

Figure 9. Percentage of implants with less than 8.5 mm in males.

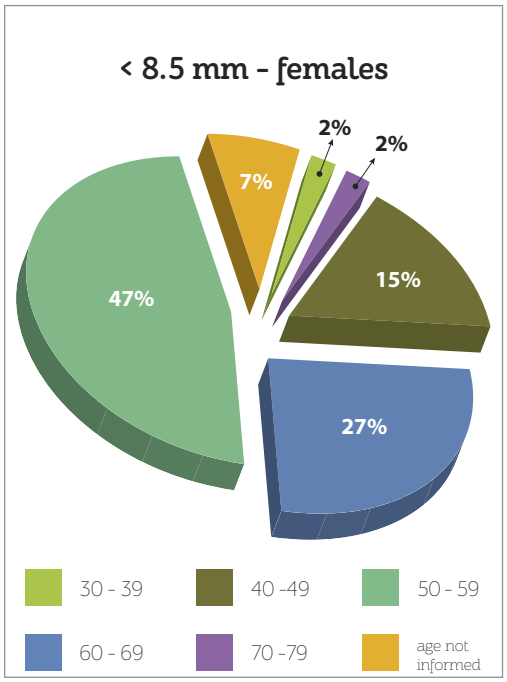

Figure 10. Percentage of implants with less than 8.5 mm in females.

a percentage of around 80%. Barboza et al[2] found 215 (61.78%) implants in female patients and 133 (38.21%) implants in male patients, which reveals women's greater concern about oral health, not only in terms of esthetics, but also to restore shape and function of the masticatory system as a whole.

Although the percentage of short implants is lower than that of long implants, their use has increased in day-to-day clinical practice. The percentage of short implants (no longer than 10 mm) use is similar to the percentage of long implants (48.6%). Short implants were developed to address cases in which long implants seem infeasible; such as proximity to the mandibular canal or the maxillary sinus, and short alveolar ridges. Should we consider the percentage of implants less than or equal to 8.5 mm, we have 14.8%.

However, our findings reveal that there is no significant difference in implant size among male and female patients: both sexes had similar percentages for short implants (both equal to or less than 10 mm and 8.5 mm). This shows that patient sex does not influence the use of short or long implants, since the anatomical features, skeletal pattern and bone formation of males and females do not significantly differ.

Age can be considered an important factor in determining the size of implants. Over time, issues that are directly or indirectly related to the use of implants emerge. Tooth loss, periodontal diseases and systemic conditions inherent to age may influence the use of implants.[16] Findings revealed that, for both sexes and for both sizes of implants analyzed (8.5 mm and 10 mm), the age group of increased implant use was between 50 and 59 years old.[16]

The rationale behind the use of short implants is that the bone-implant interface distributes most occlusal forces to the upper portion of the implant body near the ridge crest.[2] These forces, whether horizontal or vertical, unlike what happens with natural teeth, are distributed mostly at the level of the first implant threads.[6] Therefore, implant length may not be the most important factor influencing load distribution at the bone-implant interface.[7] This supports the use of shorter implants, since they offer specific advantages in certain clinical situations.[2]

Pierrisnard et al[17] confirmed that implant length may not positively affect the stress it receives, and claimed that increased diameter reduces the intensity of stress throughout implant length. On the other hand, according to Morand and Irinakis,[18] implant diameter and length should be taken concurrently into account due to their interactive effects; however, implant diameter is the most influential factor. Supporting this claim, Misch et al[19] claimed that the region where greater effort is transmitted to the implant is next to the bone crest, the apical region receives little stress.[7]

It has been shown that, the smaller the implant diameter, the less mechanical

stability and the more the risk of occlusal overload. Larger diameter could increase not only primary stability, but also the functional area at the bone crest, which results in better distribution of forces over bone tissues, thereby confirming the lower bone loss rates at the crest (0.05 to 0.8 mm) when implants with larger diameters are used.[4]

Importantly, in the long term, implant length may be more important than implant diameter due to vertical peri-implant bone loss that occurs over the years, which, in the future, may result in loss of contact between the bone and the implant surface, thus hindering stability.[4]

Research carried out in the 90s revealed low success rates for short implants, both in the maxilla and the mandible. However, these implants had no surface treatment, which limits clinical success, especially in posterior regions with low-quality bone.[2]

Short threaded implants with larger diameter are recommended in order to achieve better locking, larger surface area and better distribution of occlusal loads. Petrie and Williams[20] claim that short tapered implants should be avoided, especially in low-density bone, due to increased tension observed in the bone crest.

The risk factors for short implants cited in the literature were as follows: high crown/implant ratio, greater occlusion load in the posterior region, and low bone density in the region of premolars and molars. A strict protocol for implant indication is recommended in order to control these factors and enhance their characteristics. Short implants should be used with care in bruxism and smoker patients due to higher failure rates.[2]

The literature clearly shows that short implant therapy is effective and predictable; however, recommendation, surgical technique and prosthetic placement should be performed with care.[2]

CONCLUSION

In this study, after comparing long and short implants during a given period of time, the latter proved to be effective in clinical cases of oral rehabilitation. However, further prospective studies are necessary to yield more detailed data.

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