Review Article

SINGLE VERSUS SPLINTED SHORT IMPLANTS AT SINUS-AUGMENTED SITES

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ABSTRACT

In modern dentistry, the use of short dental implants has increased, especially in highly resorbed posterior regions. Current research indicates that the success rates of short implants are similar to conventional ones, with the perceived benefit of minimizing surgical complications and being less technically demanding. However, the available high-quality evidence, particularly from randomized controlled trials (≥Ib evidence), is limited when assessing the clinical outcomes of short implants compared to longer implants combined with the osteotome sinus floor elevation technique. The selection between single and splinted short implants in a sinus-augmented site is anuanced decision, contingent upon several crucial factors personalized to the specific clinical context of the individual patient.The selection between single and splinted short implants in a sinus-augmented site is a nuanced decision, contingent upon several crucial factors personalized to the specific clinical context of the individual patient. Single vs splinted implanted at sinus augmented. The Medline, Pubmed, Embase, NCBI, and Cochrane databases were searched for studies of patients with non-alcoholic fatty liver disease. Incidence, etiology, and management options were analyzed. The selection between single and splinted short implants in a sinus-augmented site is a nuanced decision, contingent upon several crucial factors personalized to the specific clinical context of the individual patient.

Key words: Dental implants, Short implants, Splinted implants, Sinus augmentation, Implant stability, Single implant.

Introduction

It has become common knowledge throughout the past few decades that, for oral rehabilitation, the utilization of dental implants has had a positive impact both in terms of short-term and long-term results [1]. As such, and concerning a large variety of restoration or replacement scenarios such as crown support, bridge abutments, removable denture placement, and others, dental implants are considered a reliable option. However, this practice will in all likelihood give rise to both long-term and short-term complications [2].

Introducing prosthetics into the oral cavity, such as titanium implants, creates an unmitigated difference from natural teeth in their connection to supporting alveolar bone and connective tissues: whereas the fibers of the periodontal ligament sling around natural teeth run perpendicularly, with implants the supracrestal connective tissue fibers run parallel. It is as of yet unknown if it provides additional pathways for infection or not as opposed to natural teeth. In oral implantology, osseointegrated implants are biocompatible titanium rods that are surgically attached to the alveolar bone, right up to their surface and without an interposed layer of soft tissue. Prosthetic and restorative fixtures such as abutments, crowns, and other supporting prosthetic materials are then attached to the implants. A bond then forms between the bone and the implant, a biological process called osseointegration. Upon examination, microbes that colonize implants are similar to that of surrounding teeth [3].

Rehabilitating the upper posterior area with diminished residual ridge height is a common challenge in dental practice. The emergence of short dental implants has sparked considerable interest as a viable solution for managing compromised clinical scenarios, offering potential advantages in terms of treatment duration, cost-effectiveness, and reduced complications and failures. Initial studies on shorter implants, particularly in the range of 7–8 mm, reported a 25% failure rate, suggesting an association between shorter implants and higher failure rates. However, recent research utilizing titanium plasma-sprayed implants demonstrated no significant difference in failure rates based on implant length [4].

Short implants have shown comparable or even fewer complications than their longer counterparts when combined with lateral sinus floor elevation. Despite this, there is a prevailing view that short dental implants, especially in staged or simultaneous implant placements, should be splinted for long-term success. Studies have indicated a significant association between non-splinted implants and shorter implants with increased failure rates, emphasizing the importance of careful consideration in treatment planning [5].

Contrary to the notion that prosthesis type influences outcomes, evidence suggests that the type of prosthesis has no incidence on the success of short dental implants. Studies contributing to this debate are those reporting excellent long-term outcomes for 6 to 9-millimeter-long threaded implants supporting single crowns in maxillary sinus-augmented sites. However, the controversy persists, as there is a lack of controlled studies using split-mouth designs (mouth divided into two or more segments and assigned different treatments randomly) to directly compare single versus splinted (side by side/jointed) crowns. Moreover, short and extra-short implants have gained attention as attractive alternatives to avoid additional and more complicated sinus lifting surgery in cases of severely atrophic posterior maxilla. Despite this, not much data yet exists on short and extra-short implants in areas that still require sinus lifting [6].

To date, and particularly when restored with either free-standing or splinted restorations, there is a gap in the literature regarding a comprehensive review of clinical outcomes for short and extra-short implants placed in sites that have benefited from maxillary sinus augmentations [7].

Results and Discussion

Wolff's Law states that bone will adapt to the loads above it. Based on the needed mechanical function, bone will adapt its mechanical properties [8]. The decision to choose between single and splinted short implants in a sinus-augmented site is a nuanced process, hinging on various critical factors tailored to the individual patient's clinical context. The following considerations play a pivotal role in this decision-making process:

Implant stability and primary stability

Single implants

When the primary stability of a single short implant is robust and can effectively support the intended restoration without compromising stability, opting for a single implant may be appropriate.

Splinted implants

In situations where achieving adequate primary stability poses a concern, especially with short implants, the strategy of splinting two or more implants together can bolster overall stability and provide additional support [9].

Bone quality and quantity

Single implants

Adequate bone quality and quantity that can sustain a single implant, coupled with an implant length suitable for the available bone, render single implants a viable choice.

Splinted implants

In cases of compromised bone quality or insufficient bone volume, the decision to splint short implants becomes advantageous. This approach helps distribute forces more evenly, mitigating the risk of overload on individual implants [10].

Loading protocol

Single implants

For situations where immediate or early loading is part of the treatment plan, a single implant with sufficient primary stability is a preferred option.

Splinted implants

Splinting implants become an appealing choice, especially for immediate or early loading protocols, as they provide additional support during the initial healing period [11].

Prosthetic considerations

Single implants

In cases where the restoration involves individual crowns and occlusal forces fall within the physiological range, single implants may be considered.

Splinted implants

Extensive rehabilitation, such as fixed partial dentures or full-arch prostheses, benefit from the increased support and stability provided by splinted implants.

Esthetic concerns

Single implants

When esthetics are a paramount consideration, the placement of single implants allows for a more individualized restoration and emergence profile.

Splinted implants

In esthetic zones, splinting may be preferred as it can offer better support for soft tissue contours, addressing potential complications related to appearance [12].

Patient preference

Single implants

Patients who prefer a simpler and less invasive approach may find single implants more suitable for their needs.

Splinted implants

Some patients prioritize stability over simplicity and are willing to accept the slightly more complex nature of splinted implants.

In the comparison between short implants (non-splinted and splinted), Mendoça *et al*. found no Indeed, splinted implants distributed stress more effectively on the body of the implant and the bone, especially under central load application [13]. However, there are also studies that conflict with the above, reporting more marginal bone loss around splinted implants. This has led to uncertainty regarding the necessity of splinted implants. Considering Frost's law, which emphasizes bone's adaptive response to functional loads, splinting might be unnecessary when occlusal loads are adequately transferred to the bone, as supported by studies demonstrating the reliability of short implants supporting single crowns [14]. Also, in vitro models are static and do not properly imitate the adaptive properties of living supporting bone.

Studies by Mangano *et al*. using locking-taper implants revealed reduced inflammation of peri-implant soft tissues and long-term stability of crestal bone. Platform-switching, as analyzed by Telleman, demonstrated a significant drop in marginal bone loss around platform-switched short implants compared to platform-matched ones, attributing this to concentrating stress in the central implant area. Meta-analyses also supported lower marginal bone loss with platform-switched implants, aligning with results from Schincaglia *et al*.'s study using only platform-switched implants [15].

Higher failure rates were reported for short implants in the maxilla, associated with bone types III and IV. In comparison to type III bone, Lai *et al*. found more failures in type IV, consistent with classifications by Lekholm and Zarb [16]. Risk factors for short implants also include poor bone quality and density in edentulous sites, especially with smooth implant surfaces. However, based on positioning sites, making a comparison of short implants did not yield any significant difference. This emphasizes the potential importance of bone quality over position [17].

In a study of immediately loaded short implants, higher success and survival rates were observed, but more marginal bone loss was noted around implants smaller than 10 millimeters. Immediate loading requires that healing be meticulously controlled for micro-movements, considering the intricate peri-implant bone healing process involving neo-angiogenesis and osteoconduction [18].

Few studies have explicitly compared long and short implants, and none of them showed any significant differences or performances, even at long-term follow-ups (such as a 20-year follow-up for an 8 mm implant) [17].

Conclusion

Short implants and standard implants appear to have the same survival rates over a 1-year follow-up period when used for posterior single crowns. This suggests that short implants exhibit a similar ability to withstand the challenges posed in posterior tooth replacement scenarios within the initial year after placement.

Short implants demonstrated favorable outcomes in terms of prosthetic failure, low marginal bone loss, and surgical complications. The low incidence of these complications suggests that short implants are associated with a high level of predictability and success in the context of single rehabilitation for posterior tooth loss. The positive survival rates, coupled with the minimal occurrence of adverse events, contribute to the overall reliability and efficacy of short implants as a viable treatment plan for addressing posterior tooth loss in a single-tooth replacement setting.

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