On Host Site Preservation and Augmentation for Single-Implant Replacement: Is Less More?

So-called site preservation and augmentation are frequently touted as quasi-obligatory following single-tooth extraction, especially in the esthetic zone. The profession deserves to know who drives this approach (informed patients, or product manufacturers via the enthusiastic advocacy of circuit lecturers?) and the long-term documented outcomes associated with this intervention’s claimed efficacy, effectiveness, and unintended consequences.

The alleged aims of site preservation and/or site augmentation include the following: preservation and provision of adequate bony encapsulation of implants in an ideal restorative position; supplying appropriate three-dimensional placement of implants to minimize long-term crestal bone loss; and ensuring adequate bone to support peri-implant soft tissues, thereby facilitating acceptable esthetic results. It was initially thought that if implants were placed as soon as possible in the same alignment as the extracted tooth, the ridge form would be preserved. This concept was enthusiastically embraced by the profession; however, immediate placement of an implant failed to prevent resorption and remodeling of the walls of the socket, especially on the buccal aspect. Bone recession and exposure of the head of the implant were frequently encountered, resulting in unintended esthetic consequences.

The next popular development sought to prevent bone resorption prior to implant placement via a so-called site preservation approach. Its claims were: Ridge preservation techniques were effective in limiting horizontal and vertical alterations in postextraction sockets; no one specific technique was better than another; it was successful, irrespective of closure technique; and it was effective, regardless of the cause of tooth loss. A statistically significant maintenance of ridge contour in the order of 0.8 mm was claimed, which encouraged use of a protocol that recruited many different materials for placement in extraction sockets. However, this approach also proved questionable given the resultant bony vertical changes of up to several mm that occurred in the esthetic zone in the presence of thin biotypes. Furthermore, there is limited evidence to support the benefits of alveolar ridge preservation over unassisted socket healing in improving implant-related outcomes. Unintended consequences were also frequently encountered, such as delayed healing; remnants of graft material and connective tissue remaining in the socket; inevitable and quantitatively unpredictable buccal defects due to bundle bone resorption; and even a need for augmentation at implant placement. It is alarming to note that this protocol is still all-too-frequently advocated—indeed, prescribed.

Immediate implant placement following tooth extraction suggests several advantages, including time efficiency and the possibility of eliminating the need for removable provisional tooth replacement. Moreover, mindful of earlier clinical experience, a more palatal placement of the implants was advocated to improve esthetic outcomes. This resulted in a “buccal gap” between the alveolar bone and the implant and led to the expectation that a site preservation attempt accompanied by immediate implant placement would rectify the problem. Placing autologous bone in this gap (or preferably a slowly resorbable xenograft such as the commonly used demineralized bovine bone matrix [BioOss] combined with a resorbable membrane) quickly became a formulaic protocol to ensure maintenance of the horizontal ridge contour. It has however been shown that BioOss does not completely prevent horizontal and vertical bone loss. This is the case at the implant’s platform level, where sustained bone integrity is critical for predictable esthetic outcomes.

In fact, it appears that this approach is associated with variable survival and lack of facial bone in up to 75% of sites with autologous bone and 36% of sites with BioOss and a resorbable membrane. There are also unintended consequences, such as variable bone substitution of the BioOss over time and difficulty in achieving primary closure of the site, with an attendant increased risk of infection and a treatment outcome compromise. It needs to be asserted that site preservation in conjunction with implant placement offers questionable efficacy, limited efficiency, and unintended consequences.

The next development was site augmentation—increasing the ridge volume beyond the skeletal envelope that exists following tooth extraction and managing the inevitable subsequent and unpredictable early ridge form changes that occur. A favored protocol for addressing this concern was termed early or type II implant placement and involves implant placement 4 to 8 weeks following tooth extraction. Autologous bone is placed next to the implant, and then BioOss in conjunction with a resorbable membrane is placed buccally to augment the ridge horizontally and vertically, if required, before the site is closed. Abutment connection is then carried out...
after a further 8 to 12 weeks. The total treatment time of 3 to 5 months is certainly not time-efficient when compared to immediate implant placement; however, in a 6-year follow-up of 20 patients, the augmented ridge contour was maintained and esthetic results were judged as very acceptable. It must however be emphasized that there are other disadvantages in addition to the increased treatment time, including the need for provisional tooth replacement and increased patient morbidity and costs. So, although the protocol has demonstrated relatively short-term efficacy, it has limited efficiency as well as unintended consequences. It has been shown that the odds for mesial and distal interproximal recession following horizontal site development surgery were 3.4 and 11.2 times greater, respectively, than if surgery was avoided. Given the relatively high percentage of patients where this would pose an esthetic problem, site augmentation as a valid intervention in the majority of patients becomes questionable. The long-term effects of residual BioOss particles are also not known. Their delayed presence may very well impact future circumb-implant inflammatory responses and the risk of additional marginal bone loss.

The key question remains: When are these procedures indicated? A study of 454 dental and hygiene subjects indicated that 12% had a high smile line (i.e., the maxillary anterior teeth and a contiguous band of gingiva above them revealed), 69% an average smile line (the anterior teeth and interproximal gingival only revealed), and 20% a low smile line (10% of the maxillary anterior teeth revealed). It is therefore plausible to suggest that consideration for horizontal ridge preservation/augmentation for esthetic reasons is applicable to less than 15% of patients. Furthermore, far too many clinical examples of apparently successful application of these protocols fail to differentiate whether they were esthetically relevant in the first place, since circum-oral activity/smile line details are ignored or overlooked.

Another claimed reason for site augmentation is to provide adequate vertical bone support for peri-implant soft tissues, thereby facilitating acceptable esthetics. However, it is generally accepted that the height of bone at the proximal regions of adjacent teeth rather than the vertical position of the implant will determine the contour of the interproximal papilla. Several experienced prosthodontists would contend that placing implants more palatally and within the nonaugmented alveolar bone can ensure acceptable esthetic outcomes. The increased placement depth facilitates development of a biologically acceptable and esthetically enhanced emergence profile. It will also minimize the need for cemented restorations (also initially enthusiastically advocated), which have been subsequently shown to be associated with poor biologic outcomes.

Patient judgment and satisfaction are also neglected considerations. A recent study of patients with single-implant crowns reported that only 3% had adjunctive augmentation with a xenograft and that the only factor with less than excellent patient satisfaction was associated costs. This example of patient-mediated concerns poses a compelling question: Can the added costs of site preservation/augmentation, causing even less satisfaction, be justified in the majority of cases? The profession needs to understand how and what drives current beliefs that additional surgical protocols are quasi-obligatory when restoring missing single teeth. Potential host sites should not be exclusively assessed in the context of a cheek-retracted appearance, nor managed with additional surgical protocols that lack robust and time-dependent outcome studies. A less-is-more ethos has always been a prudent and reliable approach to prioritizing patients' real needs in prosthodontics. Patients deserve best judgment and guidance, which must be provided by evidentiary counsel to ensure informed decisions regarding treatment options. The merit of a less-is-more commitment appears to be even more compelling when applications of site preservation/augmentation techniques are considered.

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References