IMPLANTS/REGENERATION

Advances in Esthetic, Immediate Tooth Replacement Therapy Aimed at Improving Clinical Outcomes

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The criteria for successful tooth replacement in the esthetic zone is comprehensive and often complex. Merely achieving osseointegration is no longer the bar that clinicians strive to reach in this endeavor. Achieving and maintaining hard- and soft-tissue stability as well as physiologic, scalloped soft-tissue architecture to frame cosmetic restorations is the ultimate goal of esthetic, immediate tooth replacement therapy (EITRT).

For immediately placed implants, both the preservation and augmentation of hard and soft tissues are critical factors. Because dimensions of the facial bone around anterior teeth are deemed thin (<1 mm) in most cases,[1] measures to preserve this bone, such as flapless therapy, should be considered. Even with caution taken, however, this bone often resorbs, and clinicians must take this into account.[2] This involves countering the physiologic negative changes that occur following extraction. The loss of height and width of the facial bone crest and volume of alveolus need to be factored in when performing EITRT. This augmentation-based concept has demonstrated significant but not complete ridge preservation.[3] Grafting the buccal "gap" associated with immediate implants has been demonstrated to preserve equal buccal–palatal ridge dimensions when compared to grafting sockets prior to implant placement.[4] Additional steps, such as soft-tissue augmentation either with soft-tissue autograft or allograft combined with bone grafting[5,6] or dual-zone bone grafting,[7] have shown to preserve ridge dimensions and increase peri-implant mucosal thickness. The author has demonstrated that combining dual-zone bone grafting with a dermal allograft (ie, Dermal Apron Technique® [term trademarked by the author]) (Figure 1) can result in soft-tissue thickness comparable to autogenous soft-tissue grafts.[6]

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Currently, immediate implant placement in the esthetic zone is performed with a palatal bias (Figure 2).[7] Angulation of the implant within the extraction socket favoring a larger buccal gap space has been shown to increase soft-tissue dimensions of the peri-implant mucosa.[8,9] With natural healing, it has been demonstrated that the volume of bone between the implant and socket wall is not maintained to the degree that grafting achieves.[10] Respecting the biologic principles of immediate implant placement and the importance of incorporating an augmentation approach, the angulation of the implant can impact the esthetic outcome in significant ways. The anatomic constraints of the premaxilla often necessitate immediate implant placement with a palatal bias and a significant facial angulation, requiring custom abutments and cement retention.[11,12] The platform of these implants, therefore, is in closer proximity to the facial bone, reducing the gap space available for grafting. This also results in pressure against the facial soft tissue because of the angled abutments, precipitating soft-tissue recession.[13] Tapered implants, which are geared toward increasing primary stability, are at their widest at the implant platform, so distances between the implant and facial osseous crest and adjacent teeth or implants are decreased.

Novel Implant Designs

In recent years, novel implant designs have been aimed at improving clinical outcomes. An implant with a built-in angle correction at the platform level not only can increase the probability of the use of screw retention but also reduce pressure placed on the submucosa, decreasing risk of recession. This subcrestal angle correction (SAC) implant design has proven to maintain marginal bone, soft tissue, and stability levels at 5 years of follow-up.[14] Additionally, the angle correction provided by the implant decreases the risk of abutment screw loosening compared to straight abutment screws when loaded in an off-axis manner.[15]

A by-product of the SAC implant design is greater distance facially between the abutment connection, or microgap, and the implant platform. This is known as a variable platform switch (VPS). This greater offset compared to traditional platform-switched connections has demonstrated increased soft-tissue thickness versus uniaxial implants for EITRT.[16]

Achieving primary implant stability at the time of EITRT facilitates immediate temporization. As previously mentioned, tapered

implants are often used instead of parallel-walled implants because of their ability to achieve a higher insertion torque and/or implant stability quotient (ISQ).[17] Unfortunately, tapered implants are widest at the platform, complicating biologic considerations. Recently, a novel, inverted body design implant has addressed the issues of achieving adequate primary stability and increasing implant–tooth or implant–implant distances, as well as reducing proximity to the facial socket wall and increasing gap space.[18,19] This implant has demonstrated the ability to achieve high levels of insertion torque, enable enhancement of thin facial bone, increase distances between the implant and adjacent teeth, and facilitate screw retention for temporary and definitive prostheses.[20] In a 1-year multicenter study, this type of implant exhibited stable ridge contours, facial bone measurements of 1.5 mm to 2 mm thickness (Figure 3), and soft-tissue thickness of 3 mm when combined with a SAC implant design and dual-zone bone grafting for EITRT.[21]

Contemporary EITRT requires surgeons to consider the long-term outcomes and how to maximize results by following the aforementioned principles. The author recommends utilizing implants that predictably achieve primary stability, respect adequate distance from facial and proximal anatomic structures, and provide opportunities for augmentation and screw retention.

Restorative Considerations

Restorative factors, such as proper sub- and supragingival abutment/crown contours,[22] physiologically favorable contact areas, and occlusal schemes, are just as critical to success as surgical factors and must be considered when fabricating temporary restorations at the time of EITRT (Figure 4). Producing smooth, under-contoured or adequately contoured subgingival provisional restorations will reduce the incidence of mucosal recession and inflammation.[23] In most EITRT cases, the temporary crown will have no occlusal contact with teeth in the opposing arch. However, final restorations are typically placed into function and require meticulous occlusal management to avoid excessive forces, which are frequently associated with abutment screw loosening or fracture. Also, the use of screw retention obviates the need for cement, which is often associated with peri-implant inflammation and peri-implantitis.

A recent study by the present author and colleagues focused on the soft-tissue thickness surrounding implants implemented in EITRT.[24] When comparing uniaxial implants to tapered SAC and inverted body design SAC implants, both of the latter types, engineered with subcrestal angle corrections and VPS, achieved more than 3.70 mm soft-tissue thickness, while the uniaxial implants achieved an average of 2.74 mm thickness. Importantly, all 46 implants in this three-part comparative study were placed into maxillary anterior sites (canine-to-canine) with identical augmentation procedures (Dermal Apron Technique). The only variable found to exert a significant effect on mucosal thickness was the implant platform. The two cohorts receiving SAC/VPS implants achieved identical and robust soft-tissue thickness. The same authors also found a correlation between the insertion torque of these inverted body design implants and the ISQ values, whereas this was not the case with parallel-walled implants in identical extraction sites.[25,26]


Fig 1.

Fig 1. A dermal allograft was adapted around a screw-retained provisional crown using the Dermal Apron Technique. **Fig 2.** Immediate implant placement with a palatal bias. **Fig 3.** CBCT scan of inverted body design implant demonstrating presence of thick facial bone, particularly at the level of the implant platform. **Fig 4.** Provisional crown with concave subgingival contour used in EITRT.


Fig 2.

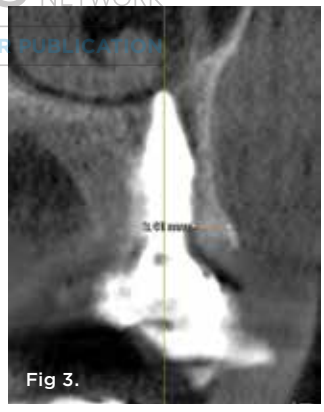
Fig 3.


Fig 4.

By increasing the primary stability of immediately placed implants and soft-tissue thickness, short- and long-term parameters of successful therapy are often achieved.

Conclusion

Successful EITRT depends on multiple factors ranging from implant selection, positioning, and design, to augmentation and temporization methods. Newer implant designs can achieve higher primary stability and increase opportunities for screw retention. Less-invasive grafting techniques reduce morbidity without compromising esthetics and bone maintenance. Proper physiologic contours of provisional restorations enhance esthetics and increase soft-tissue dimensions. While these are not the only factors to consider, they play especially critical roles in attaining optimal outcomes.

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