Immediate Implant Placement & Restoration of Single Implants in the Anterior Maxilla: What Do We Know?*

Implant installation immediately into extraction socket followed with immediate non-functional restoration has proven to be a common technique to replace failing teeth in the pre-maxilla (IPR). Many authors have claimed that IPR reduced overall treatment time with the ability to maintain soft tissue profile & bone levels. Indeed, IPR seems to be a straight forward procedure; however more detailed & careful assessment should be carried out before proceeding with such a procedure. In this series, site & patient related factors that could influence the clinical outcome of IPR will be investigated.

**Part I - Facial Bone:** Alveolar process is a tooth-dependent structure; the shape & volume of which is influenced mainly by the presence or absence of teeth. Alveolar process atrophy happens following tooth removal. Histological study of extraction socket healing in humans following tooth removal revealed new bone formation at the base of extraction socket by the seventh day. The peak of new bone formation is reached at about 100 days. Both horizontal/vertical changes in dimensions are expected in the residual ridge post-extraction. The bundle bone lining the extraction socket will lose its function & disappear. The greatest amount of bone loss is in the horizontal dimension & occurs mainly on the mid-facial bone. There is also loss of vertical dimension, which has been described to be most pronounced on the mid-facial bone. Furthermore, facial bone may be affected by previous bone loss due to periodontal/endodontic disease or trauma. Human re-entry studies following tooth extraction showed horizontal/vertical bone loss up to 63 & 22% respectively after 6 months following extraction, with rapid reductions in the first three months that was followed by gradual reductions in dimensions thereafter.

Preservation of facial bone after tooth loss in order to allow for restoration of function & aesthetics by implant treatment is one of the most challenging aims of clinicians. Different techniques have been adopted such as: IPR, grafting the extraction socket with bone/bone substitutes; guided bone regeneration/membranes & different combinations of the above options. Studies revealed that IPR failed to prevent bone loss following tooth extraction.

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Following IPR in anterior socket, facial bone would undergo remodeling, characterised by bone fill from the inside of the socket & resorption on the outside. Without the use of graft, this usually results in significant horizontal/vertical facial bone loss & subsequently in gingival tissue loss. A seven years follow-up Cone Beam CT study revealed one-third of the IPR implants almost had no facial bone detected despite bone grafting; these implants had some degree of gingival recession. Furthermore, Cone Beam CT studies showed that thick facial wall phenotype is uncommon finding in the pre-maxilla. Artifices induced by metal objects are considered to be the main limitation of these studies.

Most IPR trials advocate for intact extraction socket which is free from any bony defects as inclusion criteria. In one study pre-treatment facial bone defect morphology was classified as isolated V-shaped, or extending to interproximal regions U-shaped or extending to adjacent teeth UU-shaped defect. Bone sounding technique using periodontal probe used to determine the shape of those defects. They looked at the influence of different facial bone topography on gingival dynamics. All defects received bone/gingival graft plus membrane. At the follow-up, gingival recession of > 1.5 mm occurred in 8.3% of V-shaped defects, 42.8% of U-shaped defects and 100% of UU-shaped defects. This study shows that pre-existing facial bone morphology played significant role in determining the dynamics of soft tissue healing response; indeed postponing implant placement in cases that present with unfavourable morphology of facial bone should be considered. In another investigation facial bone was classified after tooth extraction into three categories: ideal, compromised & deficient. Ideal sockets had facial bone vertical height ≤ 3 mm relative to CEJ of adjacent teeth, in these cases bone graft & IPR was planned. Good results in terms of soft tissue outcome were achieved. Compromised sockets were characterised by facial bone vertical height of >3 mm & <7 mm. In this category, some cases were treated by delayed implant placement & others with IPR, both had bone/gingival graft. Overall, delay implant placement aesthetic success was better. Deficient cases were characterised by facial bone vertical
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height of $\geq 7$ mm. In these cases, IPR is contraindicated because bone defect imparts high risk of gingival recession; only delayed implant placement was used along with bone/gingival graft, resulting in good aesthetic outcome. Findings of this study point to the importance of assessing facial bone morphology thoroughly post-extraction before deciding to IPR. Importantly though, in sites of comprised quality that displayed soft/hard-tissue deficiencies, the outcome was very unpredictable despite attempts to compensate via hard/soft-tissue augmentation. These results need to be interpreted with great caution as number of implants & follow up were limited.

In conclusion, careful diagnostic phase includes evaluation of the morphology of facial bone to assess for integrity, height & thick phenotype is crucial before IPR.

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