CASE REPORT

Esthetic Failure following Immediate and Conventional Implant Placement in Anterior Maxillary Region: A Case Report and Literature Overview

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Implant therapy in the anterior maxilla is challenging for the clinician because of the aesthetic demands of patients and difficult pre-existing anatomy. Careful preoperative treatment planning, augmentation of hard and soft tissues, and attention to the details of implant surgical and prosthetic techniques are areas that must be addressed when treating in the anterior maxilla. Immediate placement in extraction socket has been proposed as one of the conservative and predictable methods to achieve harmonious gingival architecture that also helps in preservation of bone height and soft tissue architecture, and in maintaining the esthetic profile. The aim of this paper is to present case reports of esthetic failures seen in implants placed using immediate and delayed placement protocol and present a review of literature on the possible management of the same.

Keywords: Implant, Aesthetic failure, Immediate placement, Early placement, Delayed placement, Bone loss.
INTRODUCTION

An aesthetic implant restoration is one that resembles a natural tooth in all aspects. Difficult pre-existing anatomy and high esthetic demands make implant therapy difficult in the anterior maxillary region. To achieve successful esthetic results of dental implant placement in the esthetic zone, knowledge of various concepts and techniques become very important. Treatment of anterior maxillary region requires careful preoperative treatment planning, augmentation of hard and soft tissues, and attention to the details of implant surgical and prosthetic techniques. The positioning of implant correctly in all 3 dimensions i.e. apicocoronally, mesiodistally and faciolingually is critical for the prosthesis to be esthetically and functionally optimum.

In anterior single-tooth sites without tissue deficiencies replacement may be achieved with predictable esthetic and functional outcomes, because tissue support is provided by adjacent teeth, whereas, the treatment outcome cannot be predicted for multiple missing teeth in the anterior maxilla. The main objectives of implant therapy from an esthetic point of view in such situations is to develop inter dental papillae and to achieve a harmonious gingival margin without abrupt changes in tissue height. The skill and knowledge of the dental clinician is of utmost importance in the reestablishment of esthetics and function in complex situations in the anterior maxillary region.

Immediate placement in extraction socket has been proposed as one of the conservative and predictable methods to achieve harmonious gingival architecture that also helps in preservation of bone height and soft tissue architecture, and in maintaining the esthetic profile. It also reduces the overall treatment time and provides higher patient comfort. Early placement of implants is also preferred over the delayed implant placement technique as it facilitates early generation of interproximal papilla, the gingival margin level, and the achievement of an appropriate clinical crown height.

The aim of this paper is to present case reports of esthetic failures seen in implants placed using immediate and delayed placement protocol and presents a review of literature on the possible management of the same.

CASE REPORT 1

A 23-year-old male patient presented with fractured front teeth (Figure 1a & 1b). Intra oral examination revealed the fractured central Incisors at the middle third and lateral incisor at the cervical third extending subgingivally in the palatal aspect. Intra-oral radiographs did not show any periapical lesion. Due to lack of infection and excellent bone and gingival architecture, a treatment plan of Immediate Implant supported restoration following atraumatic extraction was planned. An informed consent was taken from the patient for the same.

The root was extracted atraumatically with periotomes and forceps were simply used to retrieve the tooth after it had been thoroughly luxated (Figure 2 & 3). The socket was debrided using a curette and the facial plate was found to be intact. Hence, it was decided to proceed with the implant placement. A Pilot drill was used to establish a new apex in the socket and to create a pathway for the osteotomy drills along the palatal aspect. Care was taken in avoiding damage to the fragile bony facial plate of the socket. The drill was centered mesiodistally and made to exit in line with the incisal edge. A 4.3 x 16 mm Nobel Biocare Replace Select Tapered™ (Nobel Biocare, Göttenborg, Sweden) implant was placed using a high torque handpiece at 30 rpm. The implant was countersunk in such a way that the upper margin was flush with the crest of the ridge. The implant abutment attachment was made invisible by the apical positioning of the implant platform below the soft tissue. The amount of this countersinking is primarily dependent on the width of the implant platform and the buccolingual-mesiodistal width of the restoration.

Clinically, the torque during implant placement is a good predictor of implant stability. The establishment of primary stability has been described as the single most important variable for success of immediately loaded implants. Studies have reported that implants placed with an insertion torque greater than 30-35 Ncm resulted in higher success rates for immediate loading.
Primary stability involves securing the implant within the host bone with sufficient rigidity to preclude any significant micromotion. The transmission of micromotion to an implant body after placement can result in crestal bone loss and failure of osseointegration. A healing abutment was placed for open/transmucosal healing approach (Figure 4), which enabled us to create the cuff around the implant and provide adequate support of the marginal soft tissues preventing tissue collapse and preserving the contour of the gingival margin. The implant axis was directed 5 degrees more palatally than that of natural tooth to prevent the encroachment
of the buccal plate, allowing minimum of 2mm thickness of buccal plate to heal without any resorption. Therefore, maintaining the support for the soft tissue (Figure 5).

After 2 days, the tissues were well adapted, healthy and the preoperative soft tissue contours had been well preserved. The healing abutment was removed and an easy abutment was placed without torque (Figure 6 & 7). An appropriate size of polycarbonate crown was selected and a provisional restoration fabricated). The polycarbonate crown was cemented using non eugenol temporary cement. All excess cement from the peri-implant area was carefully removed, as any cement left behind could hinder the proper healing of the peri-implant tissues as well as prevent the integration of the implant.
The gingival scallop was maintained at its original position and the soft tissues were found to be healthy after 2 weeks of provisional restoration (Figure 8). At this appointment, the root canal treatment for the two central incisors was completed by an Endodontist and a provisional restoration was fabricated (Figure 9 & 10). The definitive restoration was fabricated after 3 months of healing period. The definite prosthesis was cemented using temporary non-eugenol cement (Figure 11). The patient was put on a regular follow up regime as he had a poor oral hygiene. At the 6th month follow up appointment the radiographs showed bone loss extending up to the 1st thread and a negligible exposure of the polished collar. At the end of 8 months the bone level had extended up to the 2nd thread and up to 1.5 mm of the polished collar was exposed causing esthetics concerns (Figure 12 a & b).

CASE REPORT 2
A patient aged about 45 years presented with missing central and lateral incisors in the second quadrant, with deficient soft and hard tissues. A treatment plan for restoring the same with implant supported crowns following hard and soft tissue augmentation procedures was proposed. As the patient opposed to any surgical procedures, and as the extra oral examinations revealed a very low smile line displaying only the incisal thirds of the anterior teeth it was decided to proceed with implant prosthesis without augmenting the deficient tissues. An informed consent was obtained from the patient for the same. Two implants 3.5x13mm Nobel Biocare Replace Select Tapered™ (Nobel Biocare, Göteborg, Sweden) were placed in the maxillary left central and lateral incisor area and allowed for submerged healing for 4 months. Following the healing period, second stage surgery was performed and healing abutments were placed. Implant level impression was made after adequate healing and formation of the gingival cuff. Two easy abutments were used on the cast and modified to receive crowns (Figure 13). The crowns were fabricated and cemented (Figure 14). Clinical picture post treatment shows the polished gingival portion of the easy abutment, although it did not compromise the overall esthetics of the patient due to the low smile line, it did indicate an esthetic failure (Figure 15).

The functional and aesthetic success of implant treatment in the anterior zone depends on the quality of the restoration and also on the final aspect of the contour and stability of the marginal gingiva and the proximal papillae in harmony with the adjacent teeth. In Case 1 the polished collar of the implant fixture was exposed and in case 2 the gingival portion of the easy abutment was visible, in both the case reports there is an evident esthetic failure. Therefore, we checked the literature for the possible causes of failure and for options in the management of these esthetic complications.

DISCUSSION
Belser et al in an extensive literature review demonstrated that scientific documentation of esthetically relevant and reproducible parameter is rather scarce. The
There are many suggested causes for early implant bone loss leading to an esthetic failure in the anterior maxilla:

**Facial bone height and thickness**

The literature review of clinical reports on esthetic failures only reported gingival recession and periodontal indexes and rarely bone resorption. When bone resorption was reported radiographs were used to determine mesiodistal bone resorption surrounding implants but there are not many papers reporting on the changes of labial bone. It was suggested that when an implant is placed into an extraction socket it may counteract the hard tissue resorption that would occur following tooth extraction\(^{13,16}\).

Botticelli *et al* through a clinical study questioned the validity of this. In the study, 21 implants were placed into the extraction sockets of 18 patients. During the second stage surgery i.e. after 4 months of healing, it was found that most of the marginal gaps that were present following implant placement were filled with newly formed hard tissue and also that the buccal–lingual dimensions of the ridge were markedly reduced (buccal45%, lingual about 30%)\(^{17}\). Mariano *et al* in his randomized clinical evaluation supported the finding of Botticelli *et al* and concluded that Implant placement into extraction sockets will result in significant bone reduction of the alveolar ridge\(^{18}\).

Hanggi *et al* used implants with internal hex connection and reported that causes of initial bone resorption were the biologic width and the microgap between implant and abutment. And most of the resorption took place without occlusal force\(^{19}\). Cho *et al* using Cone Beam Computed Tomography evaluated the amount of bone resorption and thickness of labial bone using anterior maxillary implant, and suggested that bone thickness of more than 1.91 mm could reduce the amount and incidence of resorption of labial bone in anterior maxillary region after implant placement\(^{20}\). Spray *et al* through his study observed the change in the labial bone thickness at the time of implant placement and at the second stage surgery by measuring the labial bone thickness. They found the most prominent resorptive pattern in less than 1 - 1.4 mm of labial bone thickness, reduction of resorption level in 1.4 - 1.7 mm, remarkable reduction of resorption or no change in more than 1.8 mm

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**Figure 13** Easy Abutments Modified and Placed

**Figure 14** Final Cementation of PFM Crowns - Metal Gingival Collar of Easy Abutment exposed.

**Figure 15** Low lip line covering up the exposed polished Gingival Collar
and also had a possibility of bone formation. They suggested that for the reduction of labial bone resorption and for the frequency of bone loss, the critical thickness should be 2 mm\textsuperscript{24}.

The above review indicates that the dimension of the labial bone is critical for the success of implants placed in anterior maxillary region and for an anterior aesthetic restoration it is equally important to maintain labial bone intact in dimension and integrity.

**Gingival biotype and Inter-dental papillae**

Differences in gingival and osseous architecture have been shown to have significant impact on outcome of restorative therapy; hence knowledge and identification of the gingival biotype may be described as one of the key elements for the success of implant therapy. Romeo et al., correlated the presence of papilla between immediate single-tooth implants and adjacent teeth with a thick-flat gingival biotype\textsuperscript{27}. Evans & Chen described that in patients with immediate single-tooth implant restorations with a thin-scalloped biotype, there was more gingival recession. When an implant has adequate soft tissue volume in a vertical and buccolingual direction, then the long term stability of aesthetic soft tissue around an implant can be achieved\textsuperscript{23}. An apically placed implant with adequate volume of soft tissue can provide a good emergence profile for the implant restoration and also mask the underlying metal implant. A thin, highly scalloped gingival biotype is much less resistant to trauma from surgical or restorative procedures and, is more prone to recession. Therefore, it becomes very critical to identify the gingival biotype in any clinical practice before treatment planning is begun to help predict its outcome.

The interproximal bony crest also plays a critical role in the presence or absence of interdental or interimplant papillae. A clinical study was conducted to measure the distance from the interproximal contact point to the vertical height of bone and it was observed that how frequently the interproximal space was filled completely by soft tissue. When the interproximal contact point to the bone was 3-5 mm, papilla always filled the space, but when the distance was 6 mm papilla was absent 45% of the time and when the distance was 7 mm, papilla did not fill the space 75% of the time\textsuperscript{24}. Tarnow et al. also found that, in most cases, the vertical distance from the crest of bone to the height of the interproximal papilla between adjacent implants is 2 to 4 mm\textsuperscript{25}. Choquet et al confirmed this with implant supported restorations by a clinical and radiographic evaluative study\textsuperscript{26}. Kan et al have also shown that the height of peri-implant papillae in single tooth gaps is independent of the proximal bone level next to the implant but is dependent on the interproximal bone height of the adjacent teeth. If the distance between the tip of the papilla to the interproximal bone crest of the adjacent tooth is 5 mm or less then there is an increased likelihood that the interproximal tissues will be predictably maintained following implant placement and restoration, but if the distance is greater than 5 mm the papilla cannot be predictably maintained even after surgical intervention\textsuperscript{27}.

**Inappropriate implant positioning**

Placement of an implant is an important aspect for esthetic restoration. There are three factors that must be considered for the determination of the implant position: (1) the buccolingual and mesiodistal position of the implant platform, (2) the implant body angulation, and (3) the apical position of the implant head, which is also known as countersinking.

The ideal buccolingual-mesiodistal position of the implant platform should be at the root area of the tooth it replaces. When an implant is buccally placed, it can result in an optical reflection of the implant/abutment collar through the thin gingival tissues. But placing the implant too far lingually will result in a restoration having an abrupt and flat labial emergence profile. The implant angulation can be described as an imaginary line through which the screw access traverses the crown. An optimal angulation is when the screw is in the center of the restoration, enabling the fabrication of the restoration with a gradual emergence profile in all dimensions and that is easy to clean and maintain\textsuperscript{28}. The implant platform should be apically positioned below the soft tissue to make the implant abutment attachment invisible and also to provide enough length to form a gradual emergence profile from the implant platform to the height of contour of the restoration. For
maxillary central incisors, an implant with an average diameter of about 4mm, 2 mm to 4 mm of countersinking has been suggested\textsuperscript{39}.  

**Implant crest module**

The transosteal region of an implant, receiving stress from the implant after loading is referred to as crest module of the implant body. Until the early 1990s, the neck portion of most endosseous dental implants had a smooth machined surface, originating with the Brånemark System, and this was regarded as an effective design to prevent plaque accumulation when an implant was exposed to oral cavity because of loss of the alveolar bone\textsuperscript{30}. However, this machined neck is not an effective design for the distribution of occlusal force. Many longitudinal studies have shown the marginal bone loss up to the first thread of machined implants after a year of function\textsuperscript{31}.  

Wiskot and Belser have described the pathogenesis of bone loss related to polished surface\textsuperscript{32}. It was hypothesized that occlusal stress between bone and smooth titanium surface cannot be effectively distributed when machined implant surface is used. Minimal peri-implant bone loss was observed around implants with micro threads placed at the top of the implant as compared to those in which micro-threads were placed below. These results indicated that the micro-threads helped to stabilize the peri-implant marginal bone, and their locations played an important role in the stabilization process\textsuperscript{33}. Hansson through a finite element analysis described a positive correlation between surface roughness of the implant body and interfacial shear strength and suggested that retentive elements such as microthreads at implant neck may counteract marginal bone resorption\textsuperscript{34}.  

The amount of marginal bone loss between machined and rough-surfaced implants was compared by Zechner et al and it was concluded that significantly less bone loss was observed for rough surfaced implants\textsuperscript{35}. Furthermore, it was reported comparatively less crestal bone loss for dental implants having a rough surfaced collar and dental implants with a microthread\textsuperscript{36}.  

Buser et al stated that when the implant heads are placed at the crest of the alveolar bone, cortical bone undergoes changes in the process of establishing a biologic width, and this modeling/remodeling behavior occurs up to the level where the screw threads start and/or the roughened surface topography begins. Implant design should therefore take into consideration the bone remodeling in establishing the biological width\textsuperscript{37}. The use of a roughened collar in level with the crest of the bone may provide a positive stress stimulus to the bone and decrease bone loss in this area, while the smooth part of implant, above the level of crestal bone, can provide an area for connective and epithelial tissue contact\textsuperscript{38}.  

We therefore can infer from the above literature review that implants should be selected on a bioengineering principle. The implant body (the part in contact with the cortical bone) should have a thread profile that stimulates bone preservation.  

**Timing of Loading**

Implants when placed immediately after an extraction are more favorable for osseo-integration. By preventing recession of mucosal and gingival tissues and atrophy of the alveolar ridges, the bony receptors can be preserved. Delay in implant loading can lead to a significant amount of crestal bone loss.  

Hence immediate loading of an implant with a provisional restoration may forestall some of these negative consequences and may increase the potential for achieving an optimal emergence profile\textsuperscript{39}.  

Hui et al conducted a prospective clinical study, in which 24 patients were followed. In 24 patients, single-tooth implant placement with immediate provisional protocol was done, including 13 patients who had immediate implant placement after tooth extraction. A surgical protocol aimed at enhancing the primary stability of implants was used for all the implants placed in the aesthetic zone. A minimal insertion torque of at least 40Ncm was also achieved.  

All the implants in 24 patients were stable within the follow-up period of between one and 15 months. No crestal bone loss of greater than one thread was detected. All the patients considered the aesthetic results to be satisfactory\textsuperscript{40}. The clinical outcomes of immediately loaded implants were evaluated after 12 months of placement in the maxillary
incisal region by Lorenzoni et al. The implants were inserted with torque values of up to 45Ncm and immediately restored with unsplinted acrylic resin provisional crowns. Occlusal splints were provided for the patients. No implant failure was noticed up to 12 months after insertion. Mean coronal bone level changes at 6 and 12 months were 0.45 and 0.75mm respectively. Bone resorption seen after 6 and 12 months was less than that evaluated for implants placed using a standard two-stage procedure.

Non-submerged unloaded implants were histologically compared with early-loaded titanium screw implants in monkeys by Piattelli et al. They found a tight contact of new bone to the implant surfaces in all samples examined. Also a pattern of lamellar cortical bone was noticed around the necks of the early-loaded screws, which was thicker than in the unloaded implants. Immediate loading protocols allow treatment to be accomplished in less time, provide patients with immediate functional, aesthetic, and psychological benefits, and help to better maintain the soft- and hard tissue architecture in the wake of implant placement. Additional long-term studies evaluating the benefits and risks of immediate loading protocol for implants are needed.

CONCLUSION

The probable cause for aesthetic failure in Case 1 could be the placement of implant submarginally and loss of hard tissue attachment to the polished collar of implant. In Case 2 it could be due to non-augmentation of hard tissue prior to implant placement resulting in inadequate bone available and hence abutment collar exposure. The patient in the above mentioned cases will be reviewed after a period of 6 months. If bone loss is detected then an alternative treatment modality will be adopted to provide better aesthetic results.

Unsuccessful treatment outcomes in the anterior maxilla can sometimes lead to disastrous clinical situations. These can only be corrected with removal of the implant and subsequent tissue augmentation procedures. Therefore for successful aesthetics in the anterior maxilla, it is important to establish sound clinical concepts with clearly defined parameters with long term stability of the peri-implant tissues.

CONFLICTS OF INTEREST

None declared

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