

## FACTORS AFFECTING SUCCESS AND ESTHETIC OUTCOME OF IMMEDIATE IMPLANT PLACEMENT. A CONTEMPORARY OVERVIEW

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### ABSTRACT

Advances in dental implant design and surface treatment beside the growing interest in dental esthetics have made a paradigm shift in implant dentistry. Instead of focusing on achieving successful implant osseointegration, constructing highly esthetic implant restoration and shortening the total treatment time have become the area of interest. The new philosophy has supported the protocol of immediate implant placement that showed high success rates and esthetic results. However, careful case selection and meticulous prosthetic and surgical implant planning are essential. This review discussed and summarized the important factors affecting case selection and implant planning to achieve an osseointegrated immediately placed implant with satisfying esthetic outcomes. The affecting factors were categorized into patient-related and clinician-related factors. Patient-related factors were periodontal phenotype, post-extraction socket type, presence of infection, smoking and esthetic risk assessment analysis. Clinician-related factors included position and design of the implant, jumping gap dimensions, surgical technique for implant placement, and socket-sealing technique.

KEYWORDS: immediate, implant, esthetic, fresh socket, post-extraction.

### INTRODUCTION

The concept of implant placement into fresh extraction socket was introduced many decades ago with a rationale of preserving the shape of the alveolar ridge, reducing the total treatment time and hence higher patient satisfaction.<sup>1</sup> Although, immediate implant placement has presented

high survival rates (>95%) and superior esthetic outcomes, it had a risk of early implant failure and midfacial recession higher than delayed implant placement.<sup>2-4</sup>

Different surgical and prosthetic techniques have been reported for managing immediate implant placement. Hence, proper case selection

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and determination of the suitable surgical and prosthetic technique is the key for achieving the goals of the protocol. The aim of the present review was to discuss the various factors that can affect the osseointegration of the immediately placed implants and their esthetic outcome. These factors were categorized into patient- and clinician-related factors.

## **I. Patient-related factors:**

### **1. Periodontal phenotype.**

The 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions has defined the term “periodontal phenotype” as “the combination of gingival phenotype and bone morphotype”. Gingival phenotype is determined by gingival thickness and keratinized gingiva width, whereas bone morphotype, by the thickness of the buccal bone plate.<sup>5</sup>

The gingival thickness is evaluated by probe transparency test where the periodontal probe is inserted into the middle of the labial gingival sulcus of the upper anterior teeth. The probe is visible in thin periodontal phenotypes ( $\leq 1$  mm) and nonvisible in thick periodontal phenotypes ( $> 1$  mm).<sup>5</sup> The width of the keratinized gingiva is measured from the free gingival margin to the mucogingival junction where 5mm was the threshold for broad keratinized gingiva accompanying thick phenotype.<sup>6</sup> The thickness of bone plate is assessed using CBCT and described thick when it is  $\geq 1$  mm.<sup>7</sup> It was found that thick gingival phenotype is associated with thick crestal bone.<sup>5-7</sup>

It is difficult to determine clear clinical cut-points between thin and thick phenotypes. Hence, the constituents of the periodontal phenotype are augmented with other morphologic features; papilla height, width/ length ratio of the clinical crown of teeth, and the periodontal phenotype is classified as follow:<sup>5</sup>

1. Thin scalloped phenotype: It shows a higher association with slender triangular shaped crown, interproximal contacts close to the incisal edge with high interdental papilla and a narrow zone of keratinized tissue, clear thin delicate gingiva, and a relatively thin alveolar bone.
2. Thick flat phenotype: It shows square shaped tooth crowns, broad interproximal contact with low interdental papilla, a broad zone of keratinized tissue, clear thick, fibrotic gingiva, and a comparatively thick alveolar bone.
3. Thick scalloped phenotype: It shows clear thick fibrotic gingiva, slender teeth, narrow zone of keratinized tissue and a high interdental papilla.

Populations with thin scalloped phenotype are in higher risk of esthetic complications when undergoing immediate implant placement and hence, they are recommended for bone and soft tissue grafting.<sup>8,9</sup>

### **2. Post-extraction socket type.**

The minimal required bone height apical to the socket is 3-5 mm.<sup>9</sup> However, the morphology of soft and bone tissues of the socket is a decisive factor for determining the suitable treatment plan for implant placement. After atraumatic dental extraction, careful evaluation of the walls of the dental socket should be performed using a periodontal probe.

According to XV European Workshop in Periodontology, only intact post-extraction sockets are indicated for immediate implant placement.<sup>10</sup> Post-extraction sockets having small midfacial bone dehiscence or fenestration are indicated for early implant placement after guided bone regeneration. Post-extraction socket with severely damaged one or more walls are indicated for delayed implant placement.<sup>10</sup> However, compromised post-extraction sockets have showed successful immediate implant placement when combined with soft tissue and bone grafting.<sup>11,12</sup>

### **3. Presence of infection.**

Presence of acute purulent infection related to the tooth to be extracted contraindicates immediate implant placement as complete socket debridement is inaccessible due to the local high bacterial load carrying high risk of early implant failure.<sup>13</sup> Contrarily, chronic periapical infection can be thoroughly debrided by antibiotic prescription, rinsing with non-alcoholic chlorhexidine solutions, meticulous mechanical debridement and Er,Cr:YSGG laser.<sup>14</sup>

Periodontal infections must be treated as a part of the treatment plan then the dental alveolus is evaluated to predict the post-extraction socket type and hence, determination of the suitable surgical procedures. History of treated periodontal disease is considered as a risk factor that can affect implant esthetic outcome and survival rate.<sup>15</sup>

### **4. Smoking as a risk factor.**

Smoking is considered as a risk factor of dental implant failure and peri-implantitis as it adversely affects angiogenesis, osteogenesis, and bone metabolism in newly formed tissues and hence new bone formation is delayed.<sup>16</sup> Higher implant failure rate was observed in patients smoking more than 10 cigarettes / day and the more cigarettes daily smoked, the higher probability of implant failure.<sup>17</sup> However, successful immediate implant placement was reported when it was supported with bone grafting and submerged healing for a period of 6 months.<sup>18</sup>

### **5. Esthetic Risk Assessment (ERA) analysis.**

Esthetic risk assessment is defined as “a pretreatment assessment tool that uses clinical precursors to determine the risk of achieving an esthetic result based on known surgical and restorative approaches in given clinical situations”.<sup>19</sup> The ERA augments the patient-related factors to help the clinician to evaluate the risk factors that

can affect the esthetic outcomes of implant therapy for a patient. It adds patient’s esthetic expectations, lip line, restorative status of neighboring teeth and the mesiodistal width of the edentulous space. For example, patient having high esthetic expectations with high lip line is considered a case with high esthetic risk.<sup>19</sup>

## **II. Surgical and prosthetic factors:**

### **1. Position of the implant.**

Prosthetically-driven implant planning is the first step to establish esthetic implant restoration through providing optimal support and stability of the peri-implant hard and soft tissues hence, immediate implant placement should be avoided when prosthetically incorrect implant positioning is required.<sup>10</sup>

The optimal implant position should be slightly palatal to a line bisecting the buccolingual dimension of the intended restoration with maximum sagittal angle between the implant long axis and the occlusal plane (faciolingual implant angle).<sup>20</sup> Reduced faciolingual implant angle will result in facially over-contoured abutment and restoration encroaching on the facial soft tissue and hence mediating midfacial recession [39].<sup>20</sup>

The implant should be 4.0 mm apical to the midfacial free gingival margin and bisect the mesiodistal distance with at least 1.5 mm between the implant and adjacent teeth to avoid resorption of the interproximal bone and hence, promoting interdental papilla formation.<sup>20,21</sup> The implant depth should allow gradual subgingival contouring. Therefore, the smaller the implant diameter, the deeper implant position is required. However, implant platform should not be placed more than 4 mm apical to the adjacent cemento-enamel junction to avoid deep probing depth which may lead to marginal bone loss. On the other hand, shallow implant positioning will result in a restoration with faciogingival undercut and may display parts

of the implant-abutment assembly.<sup>20</sup> In addition, the implant depth is correlated to its faciolingual position where palatally positioned implant requires deeper implant placement to allow proper soft tissue support with gradual subgingival contouring.<sup>22</sup>

## **2. Implant design.**

The macroscopic design of the implant affects the primary stability and marginal bone loss. Implants used for immediate implant placement should have platform switching property and tapered macroscopic design with deep aggressive threads (self-tapping) that allow preparation of undersized osteotomy to achieve high primary stability.<sup>23</sup> Platform switching brings the microgap at the implant-abutment interface away from the peri-implant bone surface and increase the surface area for soft tissue seal around the implant.<sup>24</sup>

## **3. Jumping gap.**

It is the distance from the implant shoulder to the interior surface of the bony socket wall.<sup>22</sup> Implant diameter should be selected to preserve the facial jumping gap to avoid impinging on the facial plate of bone.<sup>22</sup> Management of the gap is controversial with respect to the correct technique to obtain maximum bone-implant contact and optimum esthetic results. Many authors have considered 2mm-width jumping gap is the threshold to graft the jumping gap to achieve successful osseointegration and avoid fibrous connective tissue formation around the implant.<sup>25</sup>

However, successful non-submerged implant osseointegration was reported in presence of non-grafted jumping gaps wider than 2 mm.<sup>26,27</sup> The unexpected osseointegration was explained through the ability of the jumping gap to heal via secondary intention in absence of primary closure provided that 3 local factors are present; thick facial plate of bone > 1 mm, stable the coagulum, and rough implant surface.<sup>27</sup> Although flapless immediate implant placement can survive without bone

grafting, achieving good esthetic outcome requires grafting the jumping gap to preserve the ridge shape and reduce soft tissue recession.<sup>10</sup>

## **4. Surgical technique.**

Raising a muco-periosteal flap damages the attachment of the periosteum to its underlying bone surface and induces an acute inflammatory response mediating bone resorption of the exposed area.<sup>28</sup> In presence of the osteoclastic activity on the internal surface of the bone plate as a part of the normal socket healing process, the external resorption resulting from flap reflection can cause significant height reduction of the thin facial plate of bone. Also, impaired vascular supply from the severed periosteum can delay bone formation during the initial phase of healing. This agrees with studies compared bone resorption between thin buccal and thick lingual plates of bone.<sup>28,29</sup> Consequently, when the facial plate is intact, it should be left undisturbed.<sup>22</sup>

## **5. Socket sealing technique.**

Implant placement in fresh extraction socket requires socket sealing to protect the coagulum, exposed implant surface, and bone grafting material. The extraction socket can heal with either primary flap closure (submerged healing) or secondary intention healing (non-submerged healing). While many authors have reported that non-submerged healing has higher risk of early failure (2%), others reported insignificant difference.<sup>30,31</sup> In addition, non-submerged healing have been reported to be accompanied with higher esthetic as it provides soft tissue support during the early healing process.<sup>32</sup>

Non-submerged healing is achieved through prosthetic socket seal via placement of healing abutment or provisional restoration. Immediate provisionalization requires insertion torque  $\geq 35$  Ncm and may carry high risk of occlusal forces.<sup>22,33</sup> Therefore, custom healing abutment has been suggested as a safer prosthetic socket seal to sculpt the emergence profile around the implant.<sup>34</sup>

## SUMMARY

Despite of the high success rates of immediately placed implants, they carry high risk of esthetic complications. Therefore, it is advisable to be limited to patients having intact post-extraction socket, thick periodontal phenotype, and low ERA. Presence of acute infection should contraindicate immediate implant placement.

Self-tapping and platform switching are important features of implants to be immediately placed. The implant should be selected to preserve the facial jumping gap to eliminate pressure on the weak facial bone plate and allow placement of bone graft. Whenever possible, flapless non-submerged implant placement surgical technique should be adopted to reduce bone resorption and provide soft tissue support during healing period.

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