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## Decision making tree for maxillary anterior implants: A review

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### Abstract

Main factors to be considered in decision making of maxillary anterior implants placement are labial plate thickness, soft tissue biotype, primary stability, jumping gap and the timing of implant placement. Proper diagnosis and planning of the case is key to achieve excellent aesthetic outcome. In this review, we discuss the decision making tree for implant placement in maxillary anterior region which aids the clinicians for precise diagnosis and treatment planning of the case.

**Keywords:** Decision making tree, anterior implants, aesthetic zone, immediate implants

### Introduction

Aim of implant therapy in maxillary anterior region is aesthetic and functionally stable rehabilitation of lost tooth. Timing of implant placement is determined by post extraction remodelling of socket. Buccal bone remodelling influences the aesthetic outcome in implant prosthesis. The objective of this review is to know briefly about various procedures involved in implant placement, and decision making in maxillary anterior region implant placement.

### Remodelling of Extraction Socket

The alveolar bone volume and the ridge architecture are essential to achieve an ideal aesthetic and functional reconstruction following implant therapy [1]. The height, volume, width of alveolus are determined by the presence of tooth.

Once the tooth has been lost or extracted blood clot is formed in the socket in first 24 hours. By 2nd and 3rd day this blood clot is then replaced by granulation tissue. Epithelium formation starts by the 2nd day at the entrance of the socket and by 7 th day connective tissue and osteoid formation begins. Signs of osteoid mineralization and immature woven bone formation are seen within 3 rd week of extraction. By the end of first month, the entire socket is epithelized completely. After 6 week of extraction, bone formation in the socket is prominent and trabecular mature bone is seen. The width and height of the ridge is reduced by 29 63% and 11 - 22% respectively. Fifty percent of the ridge resorption occur in first year after extraction, out of which the thirty percentage is evident radiographically in the first 3 months [2].

### Bundle bone theory

A thin dense cortical bone lining the socket wall is called bundle bone and radiographically it is described as lamina dura. Bundle bone unlike spongy bone depends only on periosteum for blood supply. In the anterior maxilla the labial wall is composed entirely of bundle bone and after tooth loss blood supply is limited which results in more pronounced bone loss.

### Treatment Options for Anterior Tooth Loss

- Immediate implant placement with or without simultaneous augmentation
- Early implants with or without simultaneous augmentation
- Guided bone regeneration for implant placement
  - Socket preservation
  - Ridge augmentation
- Socket shielding

### Immediate Implants

Immediate implants are the implants placed immediately after the atraumatic extraction, into the socket. Immediate implant placement is more advantageous since the alveolar ridge architecture can be preserved, because extraction of teeth result in buccal bone loss, necessitates the palatal positioning of implants with aesthetics complication [3, 4]. Immediate implant placement can preclude this dramatic bone loss [5].

### Indications

1. Tooth loss due to trauma with intact alveolar bone
2. Grossly decayed tooth or tooth with periodontal pathology and without any active infection.
3. Endodontic failures
4. Presence of residual root / root fracture / root perforations
5. Insufficient crown root ratio

### Contraindications

1. Dento alveolar fracture
2. Alveolar bone height is insufficient ( less than 3 mm )
3. Presence of Active infection
4. Wide or long gingival recession

### Advantages [5]

- Fewer surgical procedure
- Shorten treatment time
- Psychological support
- Improved aesthetics in early loading

### Disadvantages [6]

- Complications in placement and anchorage due to site morphology
- Technique sensitive procedure
- Thin soft tissue biotype affects the aesthetic outcome
- Lack of sufficient keratinized mucosa may result in poor primary closure

### Determining Factor In Immediate Implant Placement

#### Primary stability

- The bone apical to extracted tooth socket's is called as apical bone height. It should be minimum of 4-6 mm beyond the tooth root apex and it determines the primary stability [7] of the implant. Implant should be placed 3-5 mm beyond the apex to get primary stability and anchorage. If immediate implants are inserted into native bone and not directly into the extraction socket, good stability occurs and mobility is not detected at any interval of time. Primary stability also depends upon the implant design [8] root analog implant FIGURE 1 [27]

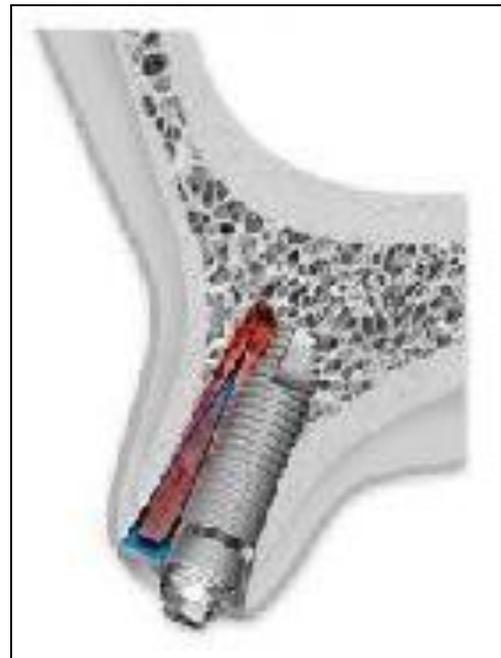


### Labial plate

Immediate implant placement is indicated only when the major part of the labial cortical wall is intact [9]. Buccal bone is primarily bundle bone in maxillary anterior region. Blood supply of Bundle bone is periosteum dependent, after extraction of tooth, blood supply to buccal plate is from Muco periosteum totally [10]. Hence buccal plate should be intact to get good blood supply. If buccal plate fractured blood supply is limited [11], which may lead to rapid resorption of labial plate leading to soft tissue recession. If labial plate is thick resorption will be less, if thin more resorption. Intact 1- 2 mm of labial plate is necessary for immediate implant placement with or without simultaneous augmentation [12]. A recent study says in 90% of cases labial bone fractured at time of extraction and buccal plate is thin in remaining 10% of cases and it is less than 1mm in thickness [13]. Araújo and Lindhe in a study [14], concluded that, by 8 weeks after extraction the buccal or labial wall move apically by 1.8 mm ± 0.2 mm and lingual wall remain unchanged. Studies have shown that bone loss is more pronounced at the buccal aspect following extraction [15-17].

### Jumping gap

Jumping gap is the space between the inner wall of buccal plate and the implant surface [18]. In the cervical region, implant should occupy entire cross section of the socket [19]. For ideal implant placement 1mm of jumping gap is acceptable. Good bone implant interface improve the stability of implant. FIGURE 2 [27].



### Determinants of Immediate Implant Placement

- apical bone height
- buccal plate and palatal plate thickness
- soft tissue biotype
- inclination of tooth
- jumping gap

### Early Implants Placement

Early implants are placed within 4 to 16 weeks after extraction with adequate soft tissue healing and partial bone formation. Early implants can be done after the resolution of infection at the site, and an increase in the area and volume of soft tissue for flap adaptation. However, these advantages are

diminished by concomitant ridge resorption in the buccolingual direction. Thus, 4–8 weeks appears to be the optimal period to defer implant placement and to allow adequate soft tissue healing to take place without undue loss of bone volume.

Depending on timing of implant placement these are

Type II – 6-8 weeks after extraction with soft tissue healing

Type III – 8-12 weeks after extraction with partial bone healing

#### **Advantages** <sup>[20]</sup>

- Soft tissue healing offers additional soft tissue volume, tension free primary closure achieved.
- Assessment of resolution pathway of extraction socket is possible.
- Dehiscence of facial wall greater than 5mm, and 2 or 3 wall defect can be managed with regenerative material easily than the delayed implants

#### **Disadvantages**

- Two surgery needed
- Defective socket morphology may effect the stability of implant
- Labial plate remodelling may result in bone resorption, soft tissue recession.

#### **Guided bone regeneration**

Good volume of alveolar bone and architecture of the alveolar ridge which favour implant placement are essential to achieve ideal reconstruction <sup>[21]</sup>. The treatment of local ridge or socket defect can be done by socket or ridge augmentation procedure and this guided bone regeneration is gold standard method to treat local defects, Alveolar bone volume determines the long term prognosis.

Alveolar ridge remodelling is main disadvantage in maxillary anterior region. Initial buccal bone remodelling, that is resorption in vertical direction is inevitable for first three weeks of post extraction, and bone formation starts at the apical end by 3 rd week. The bone formation never reach the level of bone crest of adjacent tooth <sup>[22-24]</sup>. In maxillary anterior region the alveolar resorption is rapid and large in the buccal aspect of the alveolus <sup>[25, 26]</sup>. Hence the post extraction ridge architecture and dimension preservation which is needed for delayed implant placement is done by guided bone regeneration in one or two steps.

Principle of guided bone regeneration is space maintenance given in pass principle.

#### **Pass Principle as follows**

Primary wound closure,  
Angiogenesis,  
Space maintenance and  
Stability of the wound

#### **Socket Preservation**

The term was coined by Cohen 1988

First described by Greenstein 1985

Socket preservation is the procedure, used to preserve the vertical and horizontal dimensions of socket and soft tissue architecture. Socket preservation is done immediately after atraumatic extraction and is the most important paradigm in maintaining periodontal health.

#### **Indications**

To maintain and enhance aesthetics

Improve the bone quality

#### **Advantages**

- Can be done in presence or absence of buccal bone plate
- Simple procedure
- Maintains the level of the ridge / alveolar crest

#### **Disadvantage**

Two surgeries needed for implant placement

#### **Contraindication**

- Local infection
- Systemic complications

#### **Ridge Augmentation**

Ridge augmentation is a procedure by which the required dimensions of ridge is being restored back to a conducive atmosphere for placement of implants suitable for that particular ridge.

- Indications
- Buccal plate is fractured or missing
- Vertical bone loss greater than 2/3 rd of tooth root
- Severely resorbed atrophied bone.
- Unfavorable crown/root ratio.
- Inadequate width.
- Inadequate height.

#### **Contraindications**

Smoking

Anatomical risk factors

Medical complications

#### **Advantages**

Primary closure easily achievable

Versatile procedure

Vascularity can be maintained

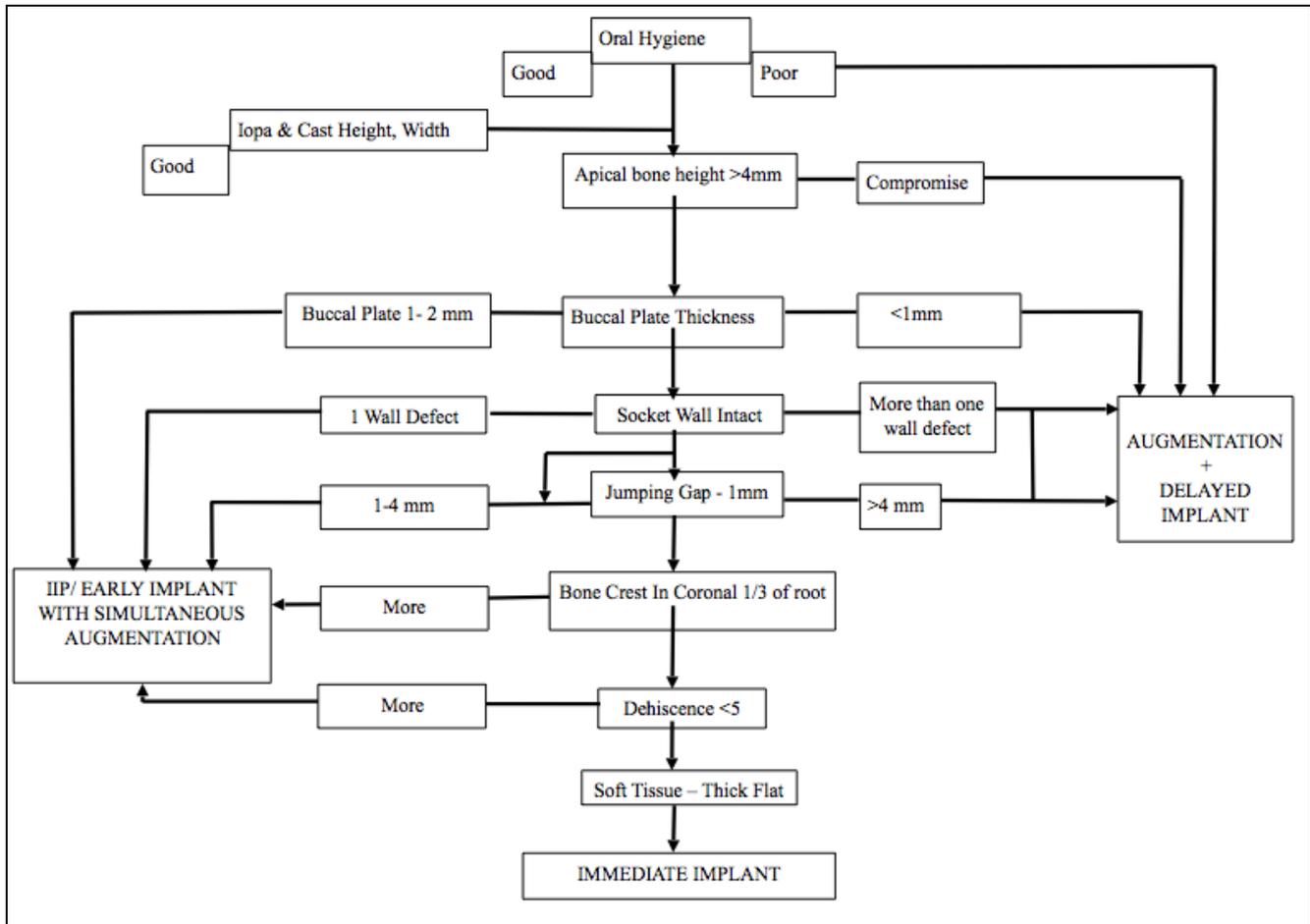
Improved bone quality and quantity

#### **Disadvantages**

Technique sensitive

Secondary mucogingival surgery may be needed

Two stage procedure in delayed implant placement



### Decision Making

In clinical practice we may face two kinds of situations with regard to implant placement. Either the patient presents with a tooth which is not restorable or the patient may report with a missing tooth. Here, we are going to discuss about the decision making process in implant placement, when the patient presents with a tooth which is not restorable. The first option which comes to the mind is atraumatic extraction of the tooth with immediate implant placement.

For a successful immediate implant placement, there are a few important criteria to be considered. The first important criteria is apical bone height, which should be should be  $>4\text{mm}$  for adequate primary stability of the implant. The second criteria is buccal plate thickness which should be greater than or equal to  $2\text{mm}$ . Other criteria include, intactness of all the socket wall, jumping gap of  $1\text{mm}$  or less, crest of the bone at the coronal  $1/3$  rd of root of the adjacent tooth, dehiscence of  $<5\text{mm}$ , and a thick soft tissue profile.

If all these criteria are not met, we can plan for immediate/early implant placement with simultaneous augmentation. For this, the apical bone height should be  $>4\text{mm}$  and buccal plate thickness should be  $1-2\text{mm}$ . The socket wall can present with a one wall defect. The jumping gap should be between  $1-4\text{mm}$ .

If the apical bone height is compromised or the buccal plate thickness is  $<1\text{mm}$  or the socket presents with more than one wall defect or if the jumping gap is  $>4\text{mm}$ , we cannot plan for an immediate or early implant. We have to go for socket preservation with delayed implant placement.

### To Decide With Timing of Implant Placement Factors Considered Are

- patient expectation

- labial plate thickness
- palatal plate thickness
- apical bone height
- extraction socket remodelling
- Soft tissue biotype
- final esthetic outcome

Hence key to success in maxillary anterior implants is presence of Adequate buccal plate thickness at the time of implant placement. The importance of Buccal plate lies in the fact that it is usually thin and more prone for fracture. Since, it is a bundle bone which has a compromised vascularity after extraction of tooth, there is a possibility for rapid resorption which, influences the soft tissue morphology and aesthetic outcome.

### Conclusion

When intact or nearly intact extraction sockets are present, immediate implant placement can be done. Ridge dimensions are crucial to be maintained every step has to be taken to preserve the dimension of post extraction socket for delayed implant placement.

### If Decision Making Is Science Judgement Is An Art

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