

# Clinical surgical analysis of implant installed immediately after tooth extraction

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## Abstract

**Introduction:** In the beginning of Implantology, the conventional protocol for osseointegration suggested waiting until twelve months for the process of alveolar bone's repair before the placement of an implant. However, osseointegrated implants can be installed after tooth's extraction at various moments. The choice of this depends on bone, functional and esthetic aspects. The insertion of an implant in the tooth socket immediately after tooth's extraction, called immediate implant, shows a technique of oral rehabilitation quite viable and science reports high rates of success, especially in the anterior region of maxillary, where there is need to obtain satisfactory esthetic results. The main indication of this is the replacement of teeth that have no possibility of treatment. This technique is very advantageous because it takes advantage of the cellular repair period, reducing surgical time, providing immediate installation of the prosthesis, function or just esthetic, which brings great satisfaction to the patient. To reach success, the practitioner must be aware of some limiting factors that may indicate against the use of the technique. **Objective:** The purpose of this article is to show the advantages and disadvantages of this technique and its indications and contraindications through a literature review.

**Abstract:** Oral surgery. Dental implants. Tooth extraction.

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## Introduction

Due to the high rate of edentulous individuals, either in whole or in part, associated with widespread dissatisfaction with conventional methods of treatment, the use of dental implants has shown significant growth. With the advancement of scientific research, numerous studies have been conducted in the field of Implant Dentistry, with the objective of perfecting techniques and materials used, making the treatment less traumatic and more aesthetically pleasing.

After the discovery of the principle of osseointegration by Professor Per-Ingvar Brånemark, dental implants have gained much credibility within the scientific community. The considerable bone reabsorption resulting from the loss of a tooth, reducing the treatment time and the final aesthetics of the patient were some of the factors that drove research on the application of dental implants immediately after extraction. This technique was given the name of Immediate Implants.

The implant applied immediately after tooth extraction has been considered a routine procedure in clinical dentistry. The advantages of immediate implantation are:

- Elimination of time waiting for repair of the socket and periodontal tissue regeneration, thus a consequent reduction in the cost of treatment.
- Reduction of surgical time by eliminating a second surgical intervention for implantation.
- Maintenance of the size of the socket in both height and thickness which leads to the required architecture of adjacent soft tissues.
- Less exposure period of the surgical aperture to external agents, reducing bone reabsorption and maintaining adequate biological spaces and interdental papilla.
- And especially, the reduction in the period of missing teeth, a fact that increases acceptability by the patient.

However, it is necessary to evaluate some of the preconditions for immediate implantation, such as the length of bone reabsorption, bone defect morphology and positioning the implant to provide an ideal position for finishing work that will result in an esthetically pleasing restoration.

To be successful at this technique, the professional must be aware of some limitations: Bone's quantity and quality in the region that focuses on obtaining primary stability; anatomy of the tooth's root that will be extracted that will determine the morphology of the residual socket, age, health and habits of the patient must be analyzed during an initial visit and may negate this treatment.

## Literature review

The original Brånemark protocol recommended a waiting period for nine to twelve months after the tooth's extraction, before insertion of any implants, so as to allow complete formation and maturity of the alveolar bone. Recent studies show that the tooth's extraction induces 23% of reabsorption of the bone crest after a period of six months, occurring severe modification of the hard and soft tissue's architecture.<sup>15</sup> Due to this, aside from the bone reabsorption of alveolar after extraction, the necessity for using temporary prosthesis for a prolonged period may aggravate the problem.<sup>9</sup>

According to Carvalho and Okamoto<sup>10</sup> the process of alveolar repair after a tooth's extraction, aims to complete the bone tissue the space left in the socket.

Experimental studies about the evolution of the repair process show that it becomes complete in about 64 days in Homo sapiens.<sup>31</sup> Murray et al<sup>28</sup> reported that three conditions are necessary for the new bone's growth: The presence of scar tissue, preserved osteoblasts and contact with viable tissue.

A disruption of the original protocol proposed by Professor Willi Schulte, in 1978, recommending installation of the implant inside of the socket immediately after tooth's extraction in order to prevent alveolar bone reabsorption and in this way, increase the quantity of bone available for osseointegration. This would also lead to a better development of esthetic and functional implanted prosthesis.<sup>22</sup>

After extraction, the natural progression of the bone's reabsorption results generally in deficient crests, which can be problematical for the future implant's placement. The implant's installation in a fresh socket immediately after the tooth's extraction is considered a predictable and acceptable treatment.<sup>19</sup>

The placement of an implant immediately after tooth's extraction modifies the standard of new growth at the bone crest and favours the maintenance of the papilla and the contour of the gingival margin, optimizing the esthetic results of rehabilitation.<sup>6</sup>

The selection of candidates for immediate implant should be careful, because all depends on the condition of the adjacent tooth, reason for loss of teeth and the quality and quantity of bone tissue and of gingival epithelium.<sup>7</sup>

Peñarrocha et al<sup>30</sup> established a classification of the period between extraction and implantation, relating to the receiving area of implant therapy:

- Immediate Implantation: When the remaining bone is sufficient to ensure the primary stability of the implant, which is inserted immediately after the tooth's surgical extraction (immediate implants).

- Recent Implantation: When a time lapse between tooth's extraction and the implantation takes place. Normally between six and eight weeks, allowing enough time for scar tissue to form, thus allowing adequate coverage of gingival mucous of tooth's socket (Mediate Implants).
- Delayed Implantation: When the receiving area is not suitable for immediate implantation and requires therapy promotion of bone using guided bone regeneration (Delayed Implants), prior to implantation.
- Mature Implantation: When the lapse of time between the tooth's extraction and the implantation takes place over a period of over nine months (Mature Implants).

### Indications

The main indication of this technique is the substitution of teeth with pathologies that do not allow treatment, including root fractures, root reabsorption, very extensive cavities, tooth's agenesis injury and cases where no apical endodontic treatment would be effective.<sup>13</sup>

Block and Kent<sup>7</sup> in their clinical experiences have established indications for implant placement immediately after tooth's extraction: Loss of teeth caused by trauma with low bone loss, teeth loss by carious processes without purulent secretion, impossibility of endodontic treatment, presence of severe bone loss without the presence of purulent secretions, minimum quantity of apical bone of 4 mm to obtain initial stability, health and appropriate quantity of the gingival epithelium to allow an occlusive patch.

### Contraindications

The morphology of residual tooth's socket can complicate the adequate positioning of the implant. Axial Curves and lacerations root location of the apex of the tooth's socket are factors that must be examined prior and can sometimes even negate immediate implantation. In anterior teeth, for example, the insertion of the implant following the direction of the tooth's socket, the long axis of the implant will have a tendency to emerge in the vestibular region, in these cases; the angle for insertion of the implant should be directed towards the palatal region.<sup>30</sup>

### Advantages

The immediate implants are installed inside the same socket as the surgical of tooth's extraction not requiring an incision for installation. This technique is called flapless surgery. In the case of installation of the immediate implant, the tooth is extracted only by the use of a periosteal elevator, without requiring incision or the exposure of the vestibular bone.<sup>3</sup>

Among the main advantages of this technique it is included the preservation of the gingival tissues and papilla in the esthetic zone, the installation of the implant in position and inclination similar to that of natural tooth and reduction of the surgical morbidity and a significant reduction in time and cost of treatment.<sup>16</sup>

This technique reduces the cost of treatment and preserves the height and width alveolar bone, facilitating the placement of the implant in relation to its length, width and angle. This is a great advantage compared to later implant, because it eliminates the healing period of the socket by reducing the surgical procedure time and thus decreases the time for the prosthesis installation<sup>21</sup>.

The immediate implant installation also may be beneficial to the final esthetic result and making the prosthesis implant-supported, since the implant is installed immediately in the same place with inclination similar to the natural tooth.<sup>24</sup>

Apparently the success of implants is similar to those of immediate implants installed in scarred bone ridge.<sup>12</sup>

### Disadvantages

The disadvantages cited in recent scientific literature are the risk of gingival recession, the need for clinical experience in more complex cases of implant for the highest safety in immediate implant installation and the non-visualization of the alveolar bone which occurs, in the case, of small variances of drill bits employed and there may be vestibular bone fractures or perforations.<sup>16</sup>

### Association with GBR

In the cases where one or more of the bone walls are lost, a dehiscence or fenestration may be formed after insertion of the immediate implant. These kinds of problems require more complex procedures with guide bone regeneration.<sup>23</sup> The technique is based on the hypothesis that the components of different cellular tissues show variable migration during the repair process.<sup>28</sup> For the correction of bone defects in immediate implant surgery, the autogenous bone promotes better results than do synthetic bone.<sup>19</sup>

Nowzari et al<sup>29</sup> studied the technique of guided bone regeneration in teeth with periodontal lesions all around of implants and concluded that when used in patients with periodontitis there is a great potential of failure due to infection.

In a recent systematic review of immediate implants it is reported that there is little definitive evidence about the effect of local infections on success and longevity of implants.<sup>12</sup>

There is no need for an integrity socket to promote osseous integration in the implants installed immediately after tooth's extraction. The use of membranes assists in bone formation. For this, it is essential that between the membrane and the exposed threads of the implant there is a space filled with a clot. If the membrane does not provide this space for the clot, there is need for filling material to maintain this space.<sup>35</sup>

## Discussion

The rehabilitation of a lost tooth in the anterior-superior region is currently one of the main challenges in Implantology. The increased demand by patients causes the step before the implant installation critical to the role in both mechanical and functional aspects, as well as esthetic. So, the extraction followed by immediate installation of implants and immediate temporary prosthesis is a very viable option and is widely accepted.<sup>17</sup>

Atraumatic extractions are essential for the success of this type of therapy. The conditions of immediate implant installation are related to the etiology of tooth's extraction and, in this case, one should observe the following aspects: Morphology of the alveolar pre-extraction, quantity of remaining alveolar bone wall (independently of the alveolar bone quality), potential for chronic or acute infections at the site and primary stability  $> \text{ or } = 35\text{Ncm}$ .<sup>16</sup>

The bone's reabsorption which occurs during the six months after the immediate implantation is the key point with which the professional is expected to work to maintain an esthetic structure peri-implant. In anterior teeth, in order to achieve an esthetic of emergence profile, the implants to be placed below the crest.<sup>30</sup>

It is known that in the region of the maxilla there is a 25% loss of bone volume in the first year and 40-60% of thickness up to the third year after tooth's extraction.<sup>8</sup> In the posterior alveolar bone region there is a loss of 50% during the same period.<sup>26</sup> Bone reabsorption can manifest itself in many aspects. In more severe cases it can lead to complete loss of osseointegration and therapy failure. In most common situations, there may be an esthetic problem, such as soft tissue changes, clinical crown lengthening and papillae disappearance and exposure of the metal band of prosthetic components. These are factors that can lead to esthetic failures. These are especially important in the anterior regions.<sup>5</sup>

Leonardo et al<sup>24</sup> compared the modification occurred *in situ* in the alveolar crest bone height around immediate implant and that induced of natural teeth, both prepared to support prosthetic devices situated on the cervical bone margin, without occlusal load. The results showed that in the peri-implant, initial re-absorption occurs in the bone crest, results in a remodeling process necessary to establish the biological space, as occurs with teeth that support crowns.

In rehabilitation of the anterior region, esthetics, especially the presence of papilla, must take into account the neighboring teeth. This is because in implants, in the same manner as in natural teeth, the presence or absence of papilla will depend on the interproximal bone crest height. Another important factor that also influences the preservation of papilla is the periodontal biotype, which is probably higher in patients with greater bone and gingival thickness giving a better chance of promoting the papilla.<sup>20</sup>

When the socket remains intact after tooth's extraction, with all its bone walls yet present, the implant can be installed immediately after of the extraction. Studies suggest implant placement 2-3 mm below the alveolar crest or apically at the level in the amelocementary line of the adjacent teeth when they are present.<sup>4,18,22</sup> It is necessary that the implant used is at least 3 mm greater than the root's apex of the recently extracted tooth in order to achieve a primary stability, so it is important there is no apical injury or infection.<sup>21</sup>

When installing implants in sockets after dental extraction the diameter of the implant does not match the exact diameter of the cavity, causing a space between the external surface of the implant body and the inner wall of the socket. This space may be filled with biomaterial, to prevent the epithelial migration into the socket and its interference in osseointegration of the implant, especially for promoting bone growth and thus allowing supporting tissue protection, maintaining the contour and gingival esthetic.<sup>16</sup>

Akimoto et al<sup>1</sup> in a study of dogs, concluded that even in areas of gap (initial space between bone and implant) of up to 1.4 mm there was after a period of 3 months of installation of the implants new bone formation with complete filling of the gaps. It is known that in faults of up to 2 mm spontaneous repair occurs and there is no need of filling the horizontal defect (HD or gap). The distance between the trabecular bone remaining and the body of the implant can be up to 3 mm, as the clot itself ensures ossification. Up to 3 mm is necessary the use GBR techniques.<sup>36</sup>

Maksoud<sup>25</sup> demonstrated insertion of implants in the posterior region after atraumatic extraction of the respective tooth. A surgical technique that involves insertion of the implant in the interseptal bone socket, multi-rooted in the posterior region, which provides initial stability to the implant and partially fills the extraction site, was used. The author reports that the bone graft and the membrane are also required to fill the cavity and allow maximum bone formation around the implant.

Biomechanics are imperative to achieve clinical long-term success. The capacity of the implant loads depend on the quality of the bone-implant interface. Therefore, modifications to the design of the implant body and the surface enhances the availability of a larger surface area, thus contributing to increase the strength of bone-implant interface, more rapid bone growth, better initial stability of the implant and a more even stress distribution.<sup>27</sup>

The selection of the diameter of the implant is a decisive factor, because it allows adequate space for conformation of the gingival tissues, minimum distance to adjacent tooth structure and, especially, a correct emergence profile of the prosthetic crown. In a study where two small diameter implants were inserted immediately after extraction without opening flaps in the region of the maxillary lateral incisors, and crowns were installed then, Carvalho et al<sup>11</sup> obtained excellent results.

In a retrospective study of seven years, some authors found 95.3% survival in the small diameter implants. In this study, 192 implants with a diameter of 2.9 mm to 3.25 mm were inserted in areas with many disabilities or limitations of prosthetic space, of which 17 were in the region of the maxillary lateral incisors. However, the implants were placed according to the conventional two-stage protocol.<sup>33</sup>

In the immediate installation of the implant, two points are relevant: The drawing and the implant surface, which can directly influence the primary stability thereof. Cylindrical-tapered implants turn easier and ease locking of bone implants placed in sockets after dental extraction.<sup>16</sup>

The implants with internal connections characteristic to Cone Morse, provide an enhanced interface between the implant and abutment, causing a cold weld between these elements, non cracking and increased resistance to micro-movements, providing a rigid connection. The Cone Morse system better distributes and supports the lateral forces of the external interface, and that of the internal hexagon.<sup>2</sup>

When, after the installation of implant the primary stability is achieved and the patient did not present any para-functional habits (e.g. bruxism) one can install prosthesis, temporarily or permanently, even if the patient is edentulous, either partially or totally. Within 48 hours after the installation of the prosthesis, the Immediate Aesthetic Load differs from the absence of direct occlusal contact with the antagonistic teeth.<sup>16</sup>

In a study with a 16-year follow up of patients, the survival rate of implants placed immediately after tooth extraction was 96% and should therefore be a procedure of choice due to its excellent survivability.<sup>34</sup>

In the anterior maxilla, where the esthetic aspect is of fundamental relevance to the patient, the implants with immediate loading characteristics have become commonplace.<sup>37</sup>

Although some studies report a greater loss of crested bone implants with immediate loading, there are also countless others showing similar results in implants in which osseointegration occurred free of load.<sup>14</sup>

According Szmuckler-Moncler, premature application of load on the implant itself does not lead to the encapsulation of the implant by fibrous tissue, but a very critical factor would be excessive movement in the implant-bone interface during the healing period.<sup>32</sup>

### Conclusion

With high rates of success, the immediate implant technique further enhances the framework of rehabilitative solutions for cases of tooth loss. The reduction in treatment time, reduction in the loss of bone reabsorption by residual socket and loss of important gingival aspects such as emergency profile and the interdental papillae, for example, are some advantages of this technique.

However, some clinical and X-ray results should be evaluated for the same applicability or contraindication of this technique: The amount of bone, which allows better positioning stability and quality of bone remaining to ensure the primary stability of the implant, the existing anatomy from the extraction site, which demonstrates the suitability or not in the use of biomaterials for the maintenance or bone formation; the socket should have the capacity to keep at least 70% of the clot for bone formation. The non-preservation of cortical and the large

expansion iatrogenic of the tooth socket during extraction may negate the suitability of immediate implant placement.

Among the attributes required for the proper use of implants are the implant shape, in which case the profile is tapered due to the proximity of the shape of the socket and the surface treatment, which scientific proof demonstrates that the surfaced implants maintain greater contact with the bone surface, thus favouring the osseointegration. The immediate implant placement in a chronically infected or periapical lesion is not disallowed, if clinical procedures before and after surgery are carefully performed, such as antibiotic administration, meticulous cleaning and alveolar debridement before surgery.

The professional must be aware of the anatomical relationships of the residual socket structures are very important, such as the maxillary sinus, nasal cavity, the mental foramen, mandibular canal and submandibular fossa. Immediate insertion should reach a depth at least 3 mm beyond the alveolar apex to achieve primary stability.

It is important to recognize that the success of immediate implant therapy is associated with constant structuring of the criteria for optimization of esthetic and functional results and development of increasingly sophisticated implants. For all this to occur, scientific research and clinical practice should always and continuously be consulted.

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