Immediate Implant Placement and Loading

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The use of dental implants in the completely or partially edentulous jaw has become a common treatment modality in restorative dentistry. Traditional techniques for treating edentulous patients with implants have been discussed in the early literature on osseointegration. These techniques encompassed extracting the tooth, waiting two to six months for the socket to heal, inserting the implant, and waiting for implant healing and osseointegration; after this procedure, surgical reentry was necessary to expose the implants and to place a prosthetic abutment. Branemark and coworkers recommended a period of stress- free unloaded healing to ensure .the osseointegration of endosseous implants. High success rates for the two-stage implant protocol have been documented. Valid paradigms have required 3-4 months of healing for tissue integration of the implants following an adequate healing period for the consolidation of an extraction socket. Taking into account the prosthetic treatment, patients frequently had to wait up to one year for a lost tooth to be replaced.

In recent years, shorter treatment times - from the time of tooth loss to the restoration of teeth with prosthetic appliances on osseointegrated implants - have been promoted by many clinicians.

Strategies were developed to substantially shorten the treatment by:

1 Immediate placement of dental implants in extraction sockets.
2 Immediate loading of implants.
3 Immediate placement and loading of implants.

Studies have documented that in cases with uncompromised osseous topography where correctly shaped implants with the appropriate surfaces were used, immediate tooth replacement has finally become a clinical reality.

The immediate placement of dental implants in extraction sites may or may not require osseous grafting, which may include the use of autogenous bone or various types of freeze-dried or decalcified freeze- dried bone graft materials from tissue banks or commercially processed bovine porous bone minerals.

Immediate placement, with or without osseous grafting, is usually, and appropriately, supplemented with the placement of guided tissue regeneration (GTR) membranes or connective-tissue membranes.

Wide-diameter stepped tapered implants that decrease in size in the apical portion obturate the socket, eliminating the need for membranes or guided bone regeneration. The staggered decreasing apical diameters prevent perforations of the concavity of the labial plate.

Studies have documented that immediate implant placement - even transmucosally -yields success rates that are as good as those of conventionally placed implants.

Advantages of immediate placement

1 Implants in fresh extraction sites can be placed in the same position as the extracted tooth, minimizing the need for angled abutments.

2 Osseointegration is more favorable when implants are placed immediate following an extraction.

3 The bony receptors are preserved by preventing atrophy of the alveolar ridge, preventing recession of the mucosal and gingival tissues. Reports indicate that a significant amount of crestal bone is lost by delaying the load on implants.

4 Non-functional restorations can be provided for better esthetics, especially in the anterior region.

5 Immediate placement of implants keeps contaminants away from the socket.

6 Waiting times for primary healing of the soft tissues and regeneration of the osseous structure are eliminated.

7 More patients will opt for implant treatment (no waiting for healing, immediate restoration)

One of the more recent cutting-edge technologies that is rapidly gaining popularity and is now available to many of our patients is immediate loading of immediately placed dental implants.

The Branemark technique calls for a peri-od of up to 12 months for post-extraction bone healing. This delay, combined with the inevitable amount of ridge resorption following extraction, may cause a number of problems; two common ones are insuffi- cient bone for ideal implant placement and prolonged treatment time.

Immediate loading of implants requires an understanding of the biology of the recipient tissues, the surgical trauma, the wound-healing process, and the occlusion of the prosthetic reconstruction.

Wound-healing studies have demonstrated osteocoating after 1 - 2 weeks following the insertion of implant with an osteophilic surface. Implant loading after two weeks may therefore turn into a feasible protocol. Certainly, early loading after 6 weeks has become routine.

Protocols for immediate or early loading

Primary and secondary implant stability: Osseointegration requires apposition to to the bone without any micromovement.

Prior dental literature cites implant micromovement as a factor in the formation of an intermediate layer of connective tissue that develops between the bone and implant, as well as of osseointegration failure. Primary stability is entirely mechanical. During the healing period, however, the biological processes of osseointegrati- on change this to a mixture of mechanical and biologic stability (secondary stability).

The importance of primary stability of immediatlely loaded implants

The concept of primary stability is of paramount importance for the survival of immediately loaded implants. Cameron and co-workers attempted to define the conditions under which porous metal will

bond to bone, with respect to implant movement. Pilliar and co-workers stated that micromovement above 150 um should be considered excessive and, therefore, deleterious to osseointegration.

In a more recent study, Brunski stated that "micromotion can be deleterious at the bone-implant interface, especially if it occurs soon after implantation." According to Brunski, micromovement of more than 100 um should be avoided, as it will cause the wound to undergo fibrous repair rather than bone apposition.

Preventing excessive micro-movement in function we may facilitate the integration of the implants with the surrounding bone.

The question remains how to avoid or prevent excessive micromovement along with function. The more pronounced the primary stability, the longer the period of mechanical stability, during which the implant will osseointegrate.

The idea is to preserve primary stability "during functional loading" long enough to attain biological stability.

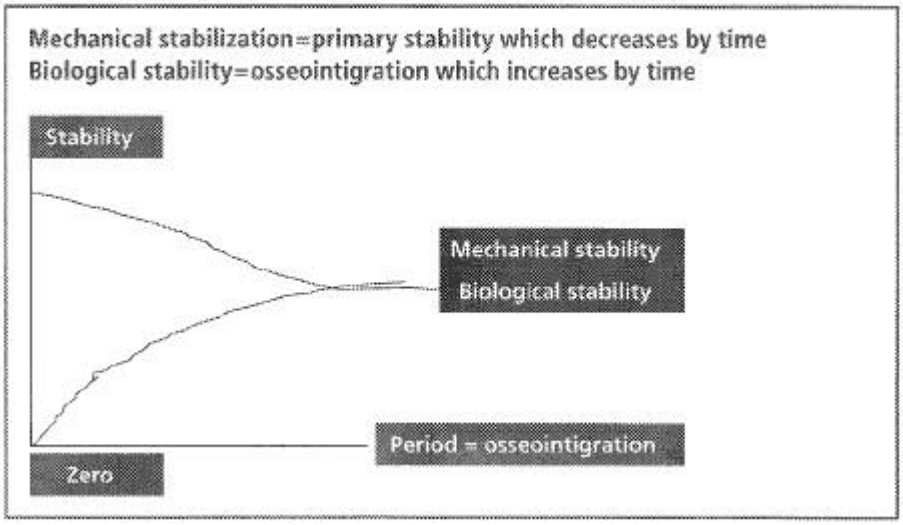

Fig. 1

Fig. 2

Achieving primary stability

1 The most important factor is the interforaminal bone at the implant site, which must be of very good quality and quantity (Dl or D2).

2 Given optima1 stabilization of the implants (at least 3) by a multi-unit bridge (full-arch fixed restorations) or by secondary splinting through the superstructure, micromovement during the healing period can be prevented.

3 Optimized surgical preparation of the implant bed includes a tapered screw implant that is wider than the prepared implant bed, inserted and fastened to a torque of at least 35 Ncrn.

4 Optimized implant form and surface:
-Tapered shape.
-Wide screw with sharp and deep thread edges (Fig. 1)
- Implant surface resembling the surrounding bone morphologically, with a sand-blasted acid-etched implant surface to maximize osseous contact during early integration. Bone healing is accelera-ted to achieve earlier osseointegration,resulting in faster secondary stability for successful loading.

It has bee documented that if a 20-Ncm counterclockwise torque does not loosen the implants at placement, the splinted multi-implant restoration may be loaded immediately. If a 50-Ncm counterclockwise torque does not loosen the implant, a functional single-tooth restoration may be placed immediately,

Figure 2 demonstrates the application of a torque exceeding 40 Ncm.

Advantages of immediate placement and loading

1 The crestal bone is maintained. Reports indicate that by delaying implant loading, a significant amount of crestal bone is lost.

2 Osseointegration is more favorable after immediate implant placement following an extraction.

3 Single-piece implants may be used (no risk of loosening abutments, low cost)

4 For implant in periodontally involved areas, immediate placement and loading enhances bone maintenance without adversely affecting osseointegration.

Methods for evaluating the periimplant bone

1-Traditional methods

Percussion tests (Adell et al., 1985)
X-ray evaluation (Lekholm & Zarb, 1985)
Periotest (Olive & Aparicio, 1990)
Turn out tests (Sullivan et al., 1996)

2-Contemporary methods

Cutting resistance measurements during implant placement (Johansson & Strid, 1994)

Resonance frequency analysis (Meredith et al., 1996)

Intraoperative recordings of the cutting resistance allow some evaluation of the bone structure (compact versus spongious) in the vicinity of the implant site. Resonance frequency analysis (RFA) measurments on inserted implants provides information on the primary stability of the implant within the bone. Where the assessment of primary stability in dental implantology was previously purely subjective, these

two new measurement methods permit an objective recording of primary implant stability.

Summary

The protocol for successful osseointegration has been based on the concept of delayed loading for over 20 years, but this concept is increasingly being questioned.

After reviewing the available literature, we conclude that there is sufficient evidence to show that, when placed in bone of adequate quality, screw-type implants can be loaded immediately if splinted together by a rigid bar, as long as they are positioned properly and

Case study

The purpose of the case study was to compare the results of immediately loaded implants in edentulous sites with immediately loaded implants in extraction sites and to present a reliable surgical and prosthodontic protocol for immediate implant loading, allowing patients to receive a fixed implant-supported prosthesis in a matter of hours. It is possible to reduce the treatment time, successfully restoring the patient's oral function by immediate functional loading of dental implants and immediately inserting an implant-supported fixed restoration.

In 2003, a 74-year-old male patient presented with a minor blow to the left lower second molar which had occurred a few months previously. The patient reported some tenderness across the labial gingiva and slight mobility of his tooth-supported fixed restoration.

A ten-unit bridge was supported by the lower right second molar, right first premolar, right canine, right lateral incisor, left lateral incisor, and left canine.

Radiographic examination revealed periodontal destruction around the lower right and left second molars, peri-apical infection around the residual roots of the lower left first molar and the left and right lateral incisors, and M2 mobility of the canines (Fig 3).

The patient declined a conventional removable denture and desired a fixed immediate rehabilitation.

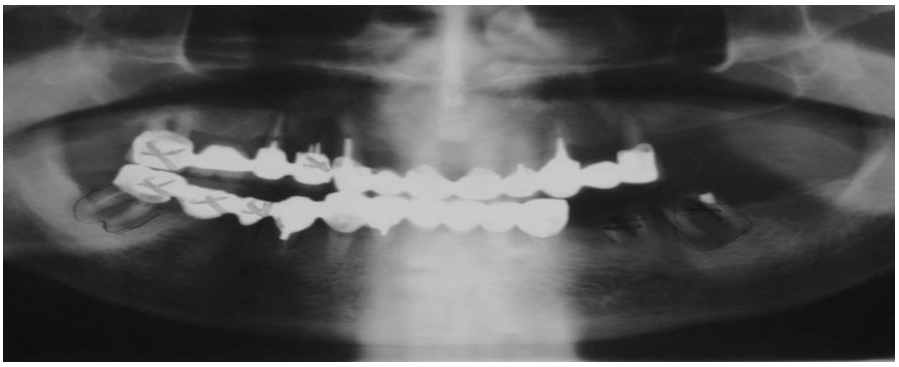

Fig. 3

Fig. 4

The clinical examination and blood tests revealed that the patient was in a good general condition in spite of his advanced age and heavy smoking habit.

It was decided to remove all remaining teeth and insert eight implants in the appropriate sites, then restore with an interim full-arch prosthesis, all in one treatment session.

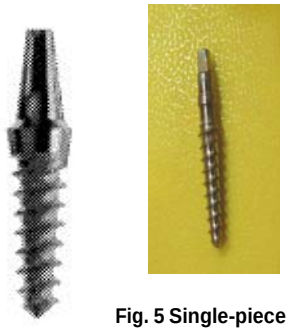

Fig. 5 Single-piece implants

Pre-surgical and prosthetic technique

The patient was premedicated with amoxicillin trihydrate and potassium clavulanate.

An impression was taken before the extraction and a temporary acrylic full- arch bridge was fabricated after removing the teeth from the stent (Fig 4).

Surgical technique

All remaining teeth were extracted under in local anesthesia. Granulation tissue was removed as well.

Six single-piece (abutment integrated, Fig. 5) implants for immediate loading were inserted, along with two standard implants for immediate loading, one in the area of the left first molar and one in the area of the right first premolar. Angulated abutments were placed on the two standard implants to achieve parallelism with the remaining abutments (Fig. 5).

Implant lengths and diameters were chosen according to the lengths and diameters of the root to be replaced. Ideally, the implant should "fill" the extraction socket in order to prevent migration of soft tissue to the implant surface, making osseointegra- tion impossible. (If necessary, bone chips from the drilling procedure can be utilized to fill the voids, covered by a resorbable membrane.)

The implants were inserted as follows, without any grafts or membranes:

Mandibular region	Allfit implant	Diameter (mm)	Length (mm)
Left first molar	STO	4.8	13
Left first premolar	CSK*	4.1	13
Left canine	CSK*	4.1	13
Left lateral incisor	KOS*	3.7	15
Right lateral incisor	KOS*	3.7	15
Right canine	CSK*	4.8	13
Right first premolar	STO	4.1	13
Right first molar	CSK*	4.1	13

* Single-piece implant.

All implants were inserted transmucosally (without flap; Fig. 6)

Advantages of single-piece implants

-No re-entry (second surgical) procedure is required.

-No risk of abutment loosening
-No need for cover screws or healing abutments (economy)
-During insertion, the visible abutments guide operators to parallelism

Implants in extraction sockets were lingually inserted 5 mm more deeply in virgin bone (Fig. 7), which has the following advantages:

-Labial bone perforation is avoided.
-The length of the implant is increased.
-Better primary stability is achieved.

In the edentulous area, the implant bed was prepared 1 mm narrower than the implant diameter; insertion torque was 50 Ncm.

The pre-prepared temporary full-arch acrylic bridge was cemented at the same appointment, to guard the wound-healing process in the extraction sockets and to guide the soft tissue (GTR) to form papillae (Fig. 8).

Postoperative surgical/prosthetic appointment

The patient was seen at one week to monitor healing.

Eight weeks later, the temporary bridge was removed, and the soft-tissue healing and implant stability were examined (Fig. 9).

The final restoration consisted of three parts - two lateral 5-unit bridges, each supported by three implants, and one anterior 3-unit bridge, supported by two implants (Fig. 10).

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

At the 3-year recall (2007), the implants and the condition of the soft tissue were examined radiographically.

No significant bone resorption was detected, and the soft tissue was in good condition around the imp1ants in both the implants inserted in edentulous sites and implants inserted in extraction sockets (Fig 11).

Benefits of this protocol

1-Fewer office visits
2-Shorter treatment time
3-Lower cost to patients
4-No removable interim denture required
Increased treatment acceptance by patients
5-Fewer surgical procedures
6-Preservation of gingival esthetics
7-Less chair time needed for dentists

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