



# Immediate Loading of Dental Implants: Overview and Rationale

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## ABSTRACT

Brånemark established the concept of osseointegrated dental implants as a predictable modality for treatment of edentulous patients. He defined osseointegration as bone-to-implant contact at the microscopic level. Osseointegration was a revolutionary concept in implant dentistry. While earlier pioneers never considered direct bone anchoring of the implant, and even established interposition of fibrous tissue between implant and bone as desirable to mimic periodontal ligament function, Brånemark et al. demonstrated that direct bone apposition at the implant surface was not only possible, but long lasting.<sup>1,2</sup>

Several long-term studies demonstrated high success rates when a strict surgical and prosthodontic protocol was followed.<sup>2,3</sup> One of the principal criteria for proper osseointegration was the need for unloaded submerged healing of the implants for a period of three to six months (two-stage approach).<sup>2-4</sup> The concern was that premature loading would cause micromotion leading to fibrous encapsulation of the implant.<sup>2,3</sup>

However, the long-term success and predictability with dental implants encouraged clinicians to reassess the



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original Brånemark protocol, since it was based primarily on clinical observations and not necessarily on biologic principles.<sup>5</sup>

The prolonged postoperative period following implant placement led to unavoidable difficulties in patient management. During this osseointegration period, several complications, including loose dentures, fractured prosthesis, sore spots and periodic provisional relines, plagued the clinician and the patient. In addition, the necessity for a removable prosthesis, even for a short period, was a deterrent in itself for some patients whose primary goal was to avoid a removable denture in the first place.

Thus, the concept of submerged healing was challenged first by Schroeder and then in animal and human studies by Ericsson et al. and Becker et al. who demonstrated that one- and two-stage approaches both led to similarly successful results.<sup>6-9</sup>

### Rationale

One-stage implants, even without occlusal loading, unavoidably bear some functional stresses in the oral cavity due to forces exerted by the tongue, cheeks, lips and the inevitable masticatory forces. Additionally, animal studies have reported that implants with treated surfaces lead to an accelerated initial healing and increased bone-to-implant contact.<sup>10-13</sup> These two findings led to the next phase of research that tested the viability of earlier loading with surface-treated implants. In a multicenter one-year study, Lazzara et al. loaded both maxillary and mandibular implants at two months postplacement, and achieved a 98 percent success rate.<sup>14</sup>

Albrektsson had postulated that early loading of implants would lead to fibrous encapsulation instead of osseointegration.<sup>15</sup> In an early study, Henry and Rosenberg questioned the validity of this assessment by treating five edentulous



**Figure 1.** Pretreatment view of a patient diagnosed with chronic severe periodontitis.



**Figure 2.** Terminal mandibular molars were maintained to stabilize the surgical guide.

patients using four implants as immediate overdenture abutments, and postulating that “controlled immediate loading” does not jeopardize the process of osseointegration. Schnitman followed 10 patients for 10 years after immediately loading some of the implants placed to retain provisional restorations, with the expectation that these implants would fail. Since most of the implants integrated without any problems, they were later incorporated in the final prostheses (Schnitman 1990, Schnitman 1997).<sup>16-18</sup> The success rate of the immediately loaded implants were 86 percent compared to 100 percent for the submerged group. While there was a statistically significant difference in success rates, the authors suggested that the quality of bone was the primary factor in the failure rate. In a retrospective five-year multicenter study, 226 patients had four implants placed interforamina, and were restored with an implant bar supporting an overdenture. The reported success rate was 97 percent with most failures occurring during the first year.<sup>19</sup>

Tarnow et al. treated 10 patients with a minimum of 10 implants in edentulous maxillary or mandibular arches. At least five of the implants were immediately loaded with fixed provisional crossarch restorations.<sup>20</sup> The patients were followed for one to five years and both immediately loaded and submerged

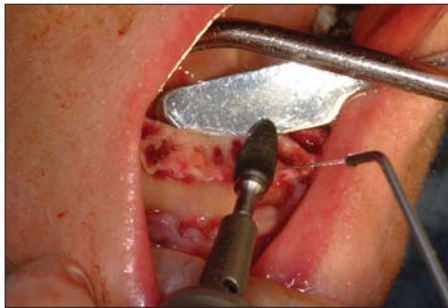
implants had a 97 percent success rate. A number of other authors similarly demonstrated that implants placed with primary stability in the edentulous arches could be loaded immediately with high success rates, when crossarch splinting is provided.<sup>21-24</sup> Osseointegration in immediately loaded implants was also demonstrated histologically by Piatelli.<sup>25</sup>

The conclusion from the numerous studies points to the observation that the critical factor in osseointegration is not early loading of the implant, but rather the absence of excessive micromotion. Initial stability seems to be a prerequisite. When implants are immediately loaded, micromotion is unavoidable; however, a certain amount up to 100  $\mu$ m seems to be tolerated and is not deleterious to osseointegration.<sup>26</sup>

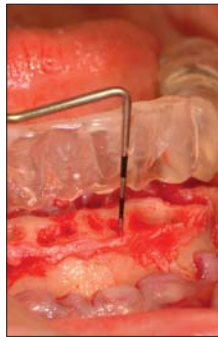
To summarize the findings of these previous studies, implants can be immediately loaded in full function provided that micromotion is controlled by following a meticulous case selection, such as crossarch stabilization, controlling occlusal overload, wide distribution of implants and minimizing cantilevered portions.

### Parameters for Immediately Loading

Based on the experience gained from the numerous studies previously mentioned, initial stability is the prerequisite for immediate loading and is

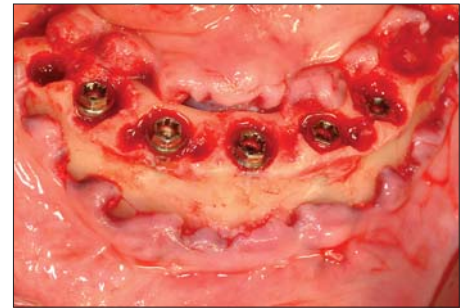


**Figure 3.**



**Figure 4.**

**Figures 3 and 4.** Alvelectomy was performed to create sufficient occlusal space for mandibular prosthesis.



**Figure 5.** Five endosseous screw-type implants were placed in the interforamina space.



**Figure 6.** Abutments and impression copings were placed. Note the retained molars maintain the patient's existing occlusal vertical dimension.



**Figure 7.** The mandibular provisional prosthesis was fabricated extraorally. Notice the highly polished tissue side.



**Figure 8.** View of mandibular provisional prosthesis in the mouth immediately prior to patient dismissal.

dependent on a number of parameters, including proper surgical technique and type of bone. Therefore, the following recommendations should be considered to maximize success:

- Implants should be at least 10 mm long.
- Adequate number and distribution of implants to provide crossarch stabilization
- Good initial stability of the implants with minimum insertion torques of 35-50 Ncm<sup>27</sup>
- Passive fit of provisional restoration
- Sufficient interocclusal space should be present for adequate bulk of provisional restoration and rigidity to minimize micromotion.
- Even occlusal contacts
- Cantilevers should be avoided or

minimized to one premolar.

■ Removal of the provisional restoration should be avoided during the osseointegration period.

■ Patients with parafunctional habits may not be ideal candidates.

### Patient Treatment Reports

#### *Patient No. 1*

This 65-year old female patient presented with severe chronic periodontitis. After discussing several options, she was treatment planned for complete mouth extractions, a maxillary removable complete denture, and a mandibular implant fixed complete denture (hybrid-type prosthesis) (Figure 1). A CT-scan of the mandible was performed to evaluate the bone for implant placement. On the day of surgery, all maxillary teeth were

extracted and a maxillary immediate complete denture placed. All mandibular teeth, with the exception of the two distal molars, were extracted. These teeth were retained to stabilize the surgical guide, which was previously fabricated (Figure 2). Full thickness flaps were raised and the alveolar ridge was recontoured to create sufficient interocclusal space (Figures 3, 4). Five 4 x 15 mm dental implants were placed using the surgical guide as a guide in the interforamina space (Figure 5). The flaps were sutured, multiunit abutments and transfer impression copings were placed, and an impression was made (Figure 6). A screw-retained provisional restoration was made extraorally, and placed (Figures 7, 8). Thus, the patient bypassed a removable mandibular prosthesis stage. Three months after implant placement, the pro-



**Figure 9.** Three months' postdelivery. Implants are osseointegrated and ready for final restoration.



**Figure 10.**

**Figures 10 and 11.** One year after delivery of definitive prosthesis. Note lingual staining due to heavy smoking.



**Figure 11.**

visional restoration was removed (Figure 9) and the final prosthesis fabricated. At the one-year recall, the patient was pleased and the restoration is functioning without any complications (Figure 10), even though the patient continues to smoke (Figure 11).

#### Patient No. 2

This 68-year old Caucasian man presented with a hopeless mandibular dentition. After discussing several options, he was treatment planned to have all remaining mandibular teeth extracted, and restored with an implant fixed complete denture (hybrid-type prosthesis). A CT-scan was performed to evaluate the bone for implant placement. Prior to the extractions, two provisional implants were placed bilaterally to stabilize the surgical guide (Figure 12). On the day of surgery, the remaining mandibular teeth were extracted (Figure 13), and five 4 x 13 implants were placed using the surgical guide as a guide (Figures 14, 15). Abutments and temporary cylinders were placed on the implants. The previously placed provisional implants were used to position the provisional restoration that was adjusted to fit around the temporary cylinders (Figure 16). The temporary cylinders were picked up intraorally using autopolymerizing acrylic resin (Figure 17). The restoration was completed extraorally



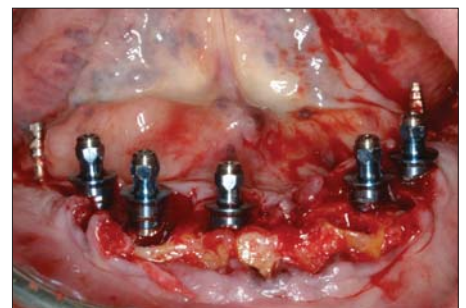
**Figure 12.** Two provisional implants were placed to stabilize the surgical guide.



**Figure 13.** Occlusal view of mandible after extractions.



**Figure 14.** The surgical guide was stabilized on the provisional implants.



**Figure 15.** Five endosseous implants were placed intraforamina.

and the screw-retained restoration was placed within hours of the extractions (Figures 18, 19).

#### Summary

Implant dentistry has continued to evolve vastly since the initial groundbreaking work of Brånemark and colleagues. Current scientific knowledge sup-

ports the feasibility of immediately loading dental implants, provided that careful patient selection, pretreatment planning and a proper surgical/restorative protocol is followed. The benefits to the patient and clinician are numerous and include shortened treatment time, avoiding a removable prosthesis phase, and minimizing the number of office visits. **CDA**



**Figure 16.** Previously fabricated provisional prosthesis was placed intraorally. Note that provisional implants help align the provisional restoration.



**Figure 17.** Temporary cylinders are picked-up intraorally using autopolymerizing acrylic resin.



**Figure 18.**

**Figures 18 and 19.** The provisional restoration is completed extraorally and placed within hours of the extractions.



**Figure 19.**

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