

# Evaluation of success rates of immediate and delayed implants after tooth extraction

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*Keywords:* dental implant • tooth extraction

**Objective** To evaluate the success rates of immediate and delayed placement of implants with respect to the causes of tooth extraction and implant positions.

**Methods** A total of 310 dental implants (immediate implants :delayed implants = 76 :234) were inserted into 80 patients. The types, sizes and positions of the implants and the causes of tooth extraction were recorded. We then investigated the relationship of implant loss with the causes of tooth extraction and placement methods.

**Results** A higher failure rate was found for the implants in the posterior region of the maxilla, and when periodontitis was cited as a reason for tooth extraction. The overall success rates were 93.4% and 95.7% in the immediate and delayed implant placement groups, respectively, after a 2-year follow-up. No obvious relationship of success rate was observed with the implant placement method, cause of tooth extraction, and implants' position.

**Conclusion** The immediate placement of implants into fresh extraction sockets could offer advantages over the delayed implant placement. It seems to be a safe and predictable method for patients.

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Implantation immediately after tooth extraction offers several advantages for both patients and clinicians, including shorter treatment time, less bone resorption, fewer surgical sessions, and easier definition of the implant position. It makes the use of longer implants possible due to the preservation of ridge height and width. Moreover, it provides better opportunities for osseointegration because of the healing potential of the fresh extraction socket.<sup>1-6</sup>

Animal studies have indicated that successful osseointegration is possible when implants are placed immediately after tooth extraction.<sup>3,7-10</sup> Several human studies have been carried out to compare the results of immediate and delayed implantation in extraction sockets,<sup>11-13</sup> showing that the immediate implant placement could provide a success rate for osseointegration similar to that obtained from the placement of implants into ossified extraction sites.<sup>3,12,14-18</sup>

The aim of the present study was to evaluate the success rates of the immediate and delayed placement of implants with respect to the causes of tooth extraction and implant positions.

## METHODS

A total of 80 patients (36 women and 44 men), aged

17–62 years with a median of 43 years, were enrolled in this study and treated with implant supported removable or fixed restorations during 1998–2001. They were informed of the risks and benefits of the immediate and delayed implant surgery. After a comprehensive observation of medical history, all the patients were identified as suitable implant candidates. The exclusion criteria were as follows: irradiated patients or patients with certain systemic diseases. Among the 310 implants, 122 were inserted into the maxilla and 188 into the mandible. A total of 234 implants were inserted with a standard implant placement protocol, and 76 implants were inserted immediately after the extraction of the teeth. One hundred and eighteen implants were placed in the anterior regions and 192 in the posterior regions of both jaws. In terms of different indications of implant placement into the maxilla, 8 delayed and 4 immediate operations were carried out due to single tooth gap, 50 and 0 due to edentulous space, 8 and 16 due to distal extension, and 28 and 8 due to fully edentulous space. Of all implant placements into the mandible, 4 delayed and

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2 immediate operations were performed for single tooth gap, 50 and 0 for edentulous space, 36 and 24 for distal extension, and 50 and 22 for fully edentulous space.

Implant positions were carefully measured with periapical and panoramic films before the operations, and preoperative casts were taken to assure that the implants would be placed in a proper site to avoid damage to anatomic structures such as maxillary sinuses, mental foramina and mandibular canals. Antibiotics were administered 1 hour before the surgery and lasted for 7 days. Oral rinses with chlorhexidine (0.2%) were used twice daily for 2 weeks.

The reasons for tooth extraction before immediate implantation included periodontitis (26 implants placed and 1 lost), trauma (5 implants placed and none lost), periapical infections (18 implants placed and 3 lost), caries (11 implants placed and none lost), and periodontitis with periapical infection (16 implants placed and 1 lost). Full thickness mucoperiosteal flaps were elevated to preserve the buccal and lingual bones, and tooth extractions were carefully performed without any complication. After the extraction, the sockets were irrigated and debrided with curettes and files, and they were prepared with standard drills attempting to use the socket bony walls as guide during drilling. ITI Straumann system (Waldenburg, Switzerland) was used for all implantation operations.

The implants were normally placed along the lingual wall of the extraction socket in the incisor and canine areas and centrally in the socket in the premolar and molar areas. All implants were initially stabilized (at least 3–5 mm of bone in their apical portion). The defects and dehiscences after implant placement were treated using freeze-dried demineralized bone grafts (Tutogen Tutoplast Spongiosa Microchips, Tutogen Medical GmbH, British) covered with bioresorbable barrier membranes (Tutogen Tutopatch Collagenous Membrane, Tutogen Medical GmbH, British). After the operations, radiographs were taken to evaluate the localization of the space between the anatomic structures and the implants. The sutures were removed 7 days postoperatively. Three to seven months later, the patients were recalled for a clinical and radiographic evaluation and then followed up for 2 years.

Statistical analyses were performed using the SPSS/PC+ version 10.0. A  $P$  value  $<0.05$  was considered significant.

## RESULTS

The surgery was successfully performed in all the patients. In the immediate or delayed implantation groups, 5 and 10 implants were lost 3–7 months postoperatively resulting in the success rates of operations 93.4% and 95.7%, respectively, and an overall success rates of 95.2%. When compared with periodontitis (3.8%), periodontitis with periapical infection (6.3%), trauma (0%) and caries (0%), periapical infection induced more lost implants.

The total failure rates for implants placed in maxilla and mandibula were 4.5% and 4.8%, respectively. The failure rate for implants placed in the posterior maxilla (6.9%) was higher than that in the anterior regions (2%). As to the mandible, the failure rate in posterior regions was higher than that in the anterior regions (5.0% vs 4.4%). In the immediate implantation group, the total failure rate was 6.6%, while it was 4.3% in delayed implantation group.

No significant difference in failure rate was found in terms of different implant types, reasons for tooth loss, methods for placement and implant positions ( $P>0.05$ ).

## DISCUSSION

The long-term success of osseointegrated implants in the treatment of completely and partially edentulous patients with a sufficient amount and quality of bone has been well documented.<sup>19-21</sup> A healing period of at least 3–6 months has been recommended between tooth extraction and implant placement, during which the treatment may be delayed and the alveolar bone resorption may result in a thinner alveolar for implant placement. In animal and human studies, successful placement of implants into fresh extraction sockets has been reported.<sup>9,17,22,23</sup> The immediate placement of implants into fresh extraction sockets can offer advantages over the delayed implant placement and should have the potential to increase the patients' acceptance of the procedure.<sup>7,24-27</sup> In this way, functional replacement and esthetic maintenance or enhancement is accomplished spontaneously. The immediate implant procedure preserves bone and soft tissue structures necessary for implant placement.<sup>28</sup> In contrast, as to delayed implant placement, pressure from prosthetic restorations during the healing time may decrease alveolar bone width and height, thereby decreasing the bone volume required for proper implant placement.<sup>15</sup>

A number of studies have focused on the failure rates of implants immediately placed into extraction sockets. Comparable failure rates have been found for implants placed immediately (2.3%) or later

(2.0%).<sup>15,28,29</sup> In this study, the failure rates of the immediate and delayed implantation were 6.6% and 4.3% respectively, without significant difference. It is emphasized that if periodontal or periapical infection is present, implantation should be delayed.<sup>3,15,28,29</sup> In this study, the failure rate of implantation was higher (16.6%) when the tooth extraction was caused by periapical infection.

Implant mobility is perceived as a decisive factor in the evaluation of implant success.<sup>30-34</sup> Although implant mobility is a typical sign of early failure, it appears to have little relevance in the recognition of later failures caused by infection. Clinical investigations have shown that the loss of implant stability arises only in the late course of the diseases because the apical portion of the implant remains ankylosed over a long period.<sup>33</sup> Radiographic diagnosis is often used to evaluate implant mobility,<sup>30,32,33</sup> which may be caused by bone necrosis due to overheating of the periimplant bone during the preparation of the implant bed, or due to premature loading of implants inserted in recipient sites with poor bone quality.<sup>35</sup> And implant mobility has been regarded as one of the key parameters of successful implantation.<sup>30,32-34,36</sup> In this study, the major sign for implant failure was implant mobility. If the mobility was observed, the implantation would be considered failure.

One of the reasons for short-term implant loss is the failure to obtain primary stability. Impaired bone height and a paucity of dense compact bone contribute significantly to such diminished implant.<sup>21,31,37</sup> Our findings exhibited unfavorable results against posterior maxilla as described above. Poor bone mineral density in the posterior maxilla can adversely affect initial implant stabilization because of insufficient connection between the implant and the bone. This study confirms that implants in the posterior maxilla appear to have a less favorable success rate compared with anterior maxilla, and mandibular anterior and posterior implants. Implant loss at later stages of prosthetic rehabilitation is mainly due to infection or overloading of the implants.<sup>21</sup> During the follow-up of two years after the prosthetic rehabilitation, no implant failure was observed in this study.

In summary, the immediate placement of implants into extraction sockets seems to be a safe and predictable method, the main advantage of which is obtainments of time and bone volume.

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