Full-arch implants in periodontally compromised patients

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The study aimed to evaluate the long-term clinical and radiographic results of immediate dental implant placement and occlusal loading in periodontally compromised patients.

The study involved 42 patients with periodontitis who required the extraction of all remaining teeth and underwent immediate implant placement (588 implants; Bio3 Progressive, Bio3 Implants) into the fresh extraction sockets. Before implantation, all the patients underwent a set of clinical and radiographic examinations. Implant stability was measured using resonance frequency analysis (Osstell Mentor, Osstell) during implant placement and before fixation of the definitive prostheses. All implants underwent immediate occlusal loading with a provisional acrylic resin fixed denture. The definitive prostheses were completed three to five months after implant placement.

There were no complications during implant placement. Immediately postoperatively, there were no signs of infection around the implants, nor at the follow-up visits. Four weeks after implant placement, the soft tissue was in a healthy condition, evidenced by its pink colour and texture. After 12 months, the mean bone loss was 0.94 mm. After 36 months, the mean bone loss was 1.28 mm, and finally, after 60 months, the mean bone loss was 1.42 mm. For 588 measured implants, the mean resonance frequency analysis was 63.7 ISQ at the time of their placement and 72.4 ISQ after three to five months. Patients were satisfied with the functional and aesthetic results of the rehabilitation: masticatory function was restored, and facial profile aesthetics and occlusion were improved. The success rate of the implants after five years was 96.3%.

Immediate implant placement after tooth extraction can be a viable alternative to delayed implant placement in patients with periodontitis and can provide better aesthetics. Regular follow-up visits after such complex rehabilitation are key to long-term success.

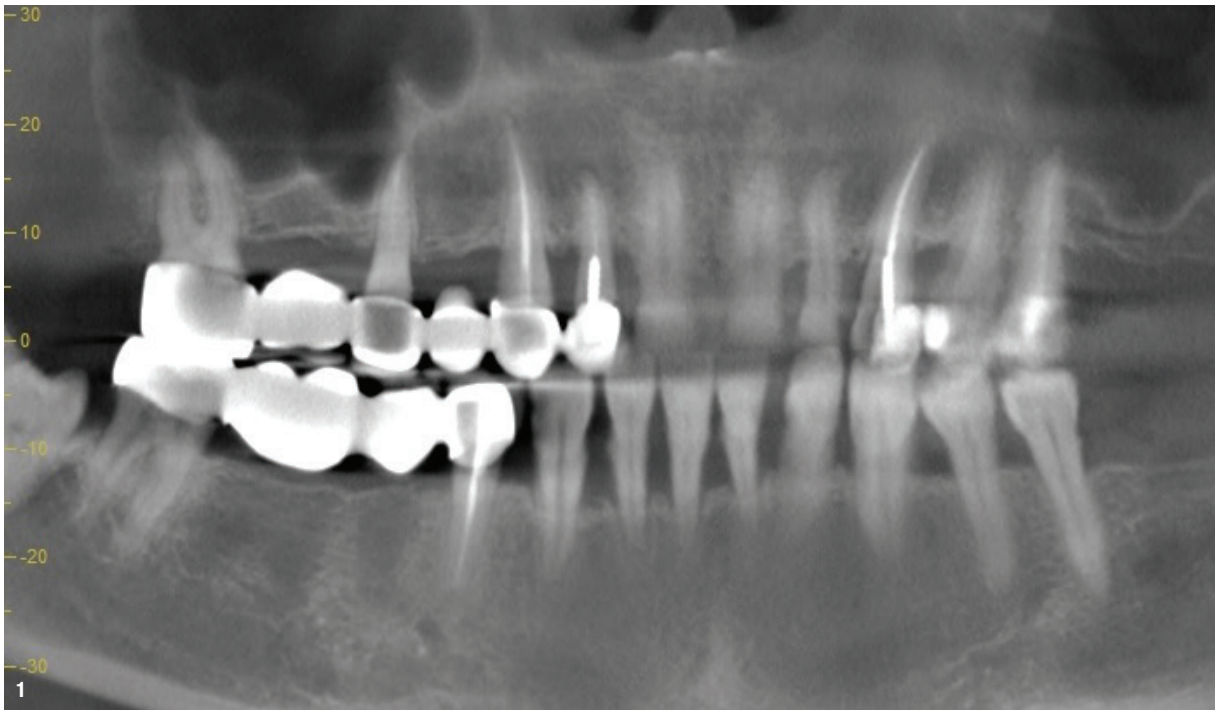


Fig. 1: Initial situation of a periodontally compromised patient.

Introduction

Dental implantation is a well-established, scientifically proven method of treating patients with partial and complete tooth loss.[1] The early rehabilitation of periodontitis patients with tooth loss is a topic of debate in implantology. Traditionally, a two-stage implantation technique is used. The main disadvantage is the additional time for the healing of the socket (three to four months) and osseointegration of the implant (three to six months).[2] In some cases, this is unacceptable for patients, especially when the teeth to be restored are in an aesthetically sensitive area. Immediate implantation allows significant reduction of the treatment time and improvement of the functional and aesthetic results by helping to prevent atrophy of the bone of the alveolar process, as well as reducing the number of surgical interventions.[3–5] Immediate placement of implants in extraction sockets was first described more than 30 years ago by Schulte and Heimke.[6]

After tooth extraction, a complex cascade of biochemical and histological processes is initiated during the wound healing period, leading to physiological changes in the bone and soft-tissue architecture.[7] These processes trigger an inevitable remodelling of the alveolar ridge that influences implant therapy in the edentulous area.[8] Several studies have shown that atrophic processes begin to develop in and around the socket area immediately after tooth extraction. The volume of bone decreases, and the structure and volume of the attached keratinised gingiva change.[9,10] During the normal bone healing process after tooth extraction, there is significant resorption of hard tissue, especially on the vestibular side, due to the thinner bone in this area and the presence of weak bundle bone. During a healing period of three to six months, there is a significant loss of tissue volume, particularly in the first three months after extraction.[11] These resorptive changes make it difficult to achieve an aesthetic result with definitive prostheses, especially in the anterior area. When the socket of the extracted tooth has intact walls and well-preserved surrounding soft tissue, it offers the ideal conditions for immediate implant placement.[12]

Earlier publications on immediate implantation warned of many complications, such as wound edge divergence and alveolar ridge resorption.[13] Several authors expressed the opinion that it was inappropriate to adopt this approach owing to the uncertainty of achieving good, predictable results and the difficulties that may arise during surgery.[14] The most frequent complications of immediate implant placement are early implant failure due to contamination of the operative field and infection, as well as fenestration and dehiscence, unacceptable aesthetics resulting from poor implant positioning, and gingival recession.[3]

Other authors, however, reported favourable outcomes with this approach, demonstrating that it can support successful prosthetic rehabilitation, including aesthetically pleasing results and earlier restoration of function.[15,16] Potential advantages of this treatment approach include a reduction in the number of surgical interventions, a shorter treatment time, preservation of alveolar bone and maintenance of soft-tissue aesthetics.

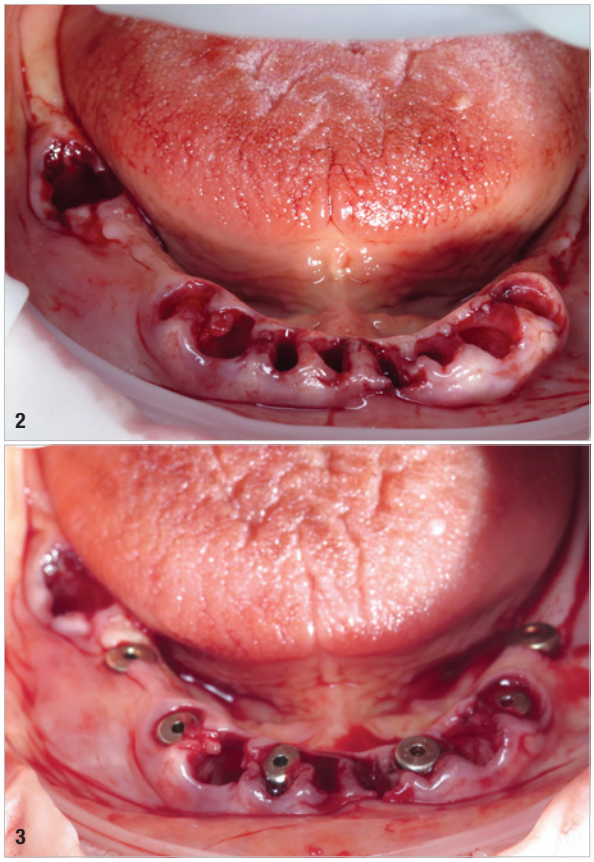


Fig. 2: Situation after extraction of all the remaining mandibular teeth. – **Fig. 3:** Six Bio3 Progressive implants placed in the mandible.

To achieve optimal results, the following principles should be observed: (1) the length of the implant should be greater than that of the extracted tooth; (2) the implant must achieve primary stability, which is supported by intercortical fixation and placement of the implant in freshly processed bone; and (3) the surgeon should adhere strictly to the treatment protocols. Patient rehabilitation should be carried out over a period of up to four to six months. Immediate implant placement is indicated when tooth extraction is due to trauma, an endodontic lesion, a root fracture, root resorption, a root perforation or periodontal loss.[4] Contra-indications include presence of active infection, insufficient bone (< 3 mm) beyond the socket apex for primary implant stability and insufficient bone width.[17]

One of the more controversial issues is immediate implantation in infected sites. Some studies have shown that placing an implant directly into a socket with peri-

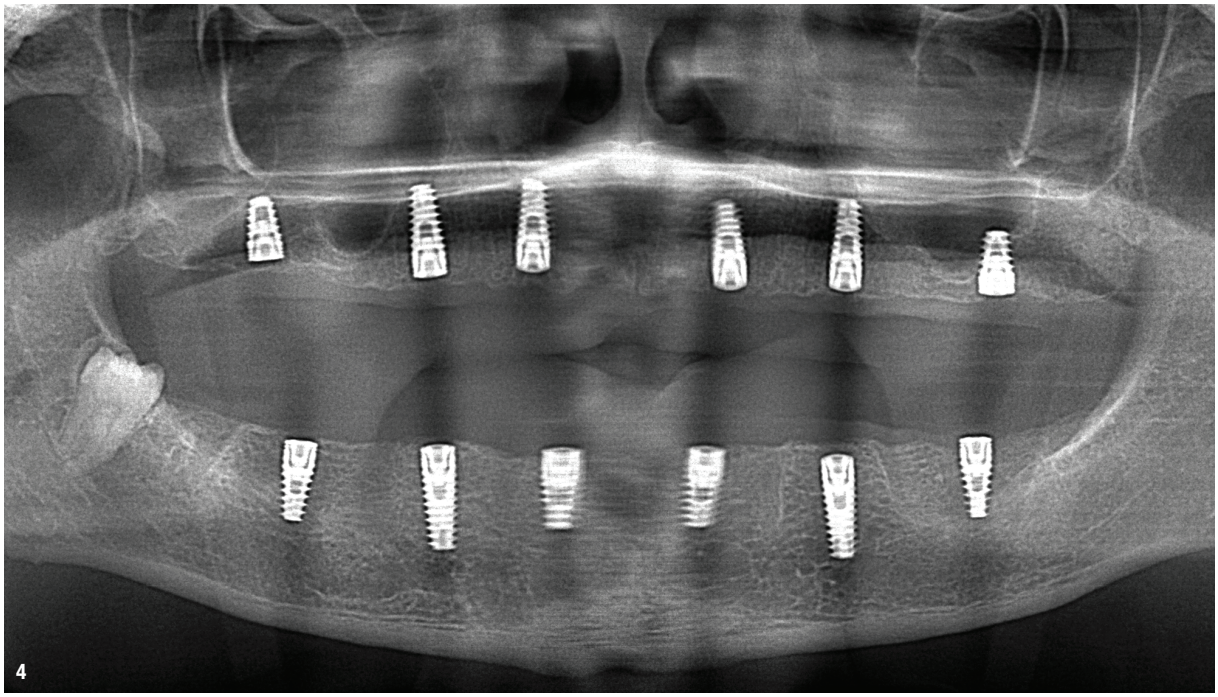


Fig. 4: Radiographic examination four months after implant placement.

apical infection significantly increases the likelihood of implant failure, compared with an uninfected socket.[18, 19] However, recent evidence has demonstrated that immediate implant placement in areas with chronic periapical lesions can be successful.[20–22]

A common reason for tooth extraction is chronic periodontal disease. It is known from the literature that, even after extensive antiseptic irrigation after extraction of teeth affected by periodontitis, pathogenic bacteria can persist, necessitating thorough curettage of pathological granulation tissue from the sockets. Because of the high risk of implant failure in such cases, immediate placement of implants in periodontitis-infected sites was avoided.[23] However, some studies have shown similar success and survival rates for immediate implants in infected sites compared with non-infected sites, suggesting that it may be a viable and effective treatment approach.[16, 24–26]

Immediate implant placement and immediate implant loading cannot be applied to every patient however. In comparison with conventional implant treatment, the ideal situation for immediately loaded implants includes adequate bone quality (at least Class D2 bone), minimum implant length of 10 mm, adequate primary stability and avoidance of lateral forces.[27]

Materials and methods

The study involved 42 patients with severe periodontitis who required extraction of all remaining teeth and received immediate implant placement into the fresh extraction sockets. All the patients showed functional and aesthetic problems. The patients (24 men and 18 women) ranged between 38 and 64 years of age (mean: 64.7 ± 10.6 years).

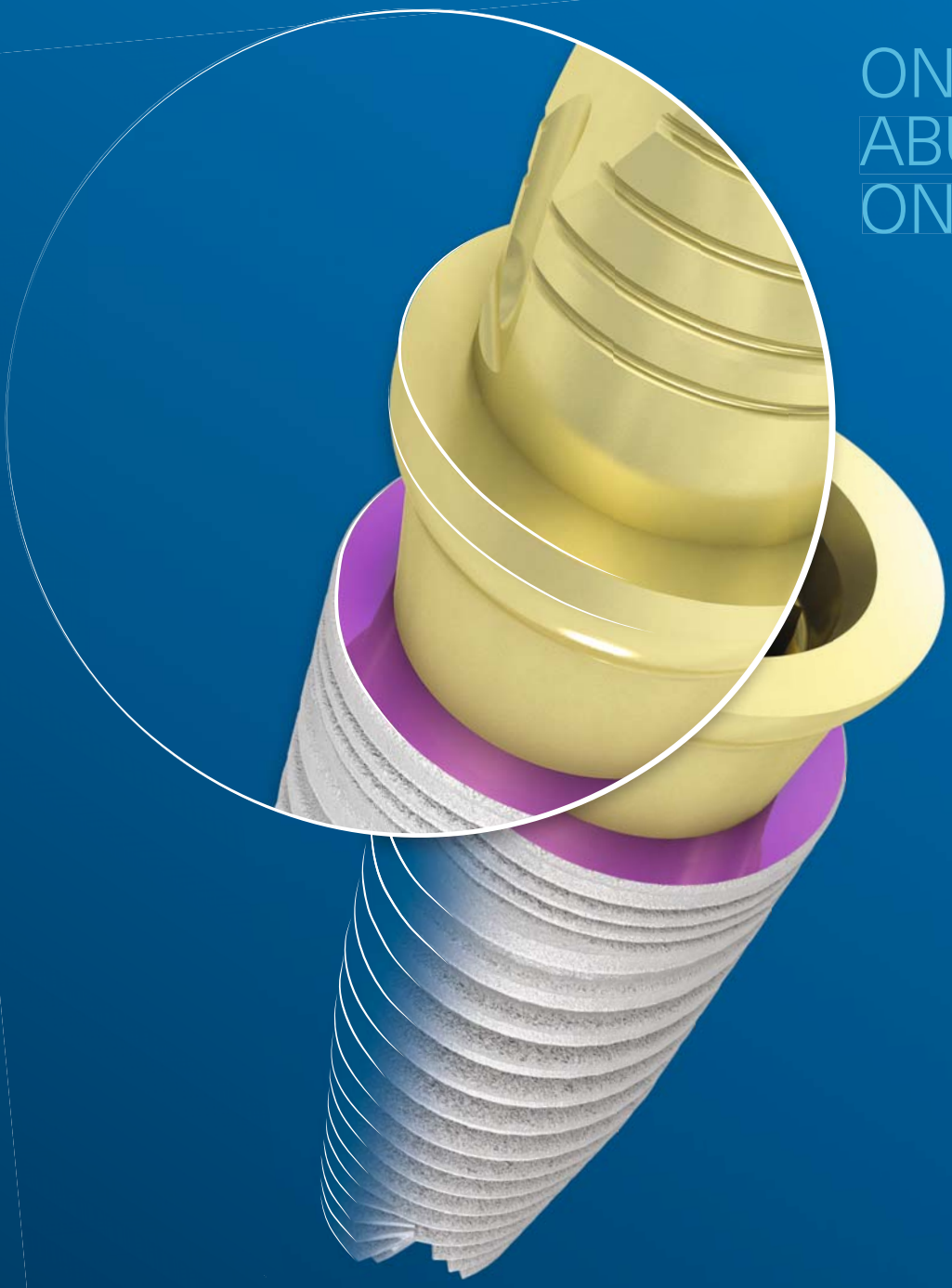
The study was conducted according to the principles outlined in the Declaration of Helsinki on clinical research involving humans. The ethical committee of the University of Seville in Spain approved the study protocol (No. 168/2022). All the patients provided written informed consent for implant placement and for inclusion in the clinical study.

The inclusion criteria were as follows:
- between 30 and 65 years of age and in good general health (ASA Class I or II);
- presence of four bony walls of the extraction socket;
- diagnosis of periodontitis based on clinical and radiographic assessments (according to the new periodontal classification from 2018);[28] and
- presence of teeth affected by periodontitis and deemed untreatable.

The exclusion criteria were as follows:
- uncontrolled chronic systematic disease;
- coagulation disorder;
- alcohol or drug abuse;
- acute or chronic autoimmune mucosal disease;
- smoking (more than ten cigarettes per day); and
- use of any medication or presence of any health condition that contra-indicated implant treatment.

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Before implantation, all the patients underwent extensive clinical and radiographic examination, including CBCT scans to assess the quality and quantity of the bone. No implant surgery was performed before optimal motivation of and compliance by each patient had been achieved. No bone augmentation procedures were performed either prior to or concomitant with implant surgery. The treatment protocol has been described by Roccuzzo et al.[29]

The patients were given amoxicillin clavulanate (AUGMENTIN 1 g, GlaxoSmithKline) 1 hour before the implant surgery. Before the implant surgery, all remaining teeth were extracted with minimal trauma to the extraction socket and surrounding bone. After tooth extraction, the socket was immediately curetted to remove granulation tissue and rinsed with a 0.2% chlorhexidine digluconate solution. Implants of appropriate dimensions were selected and placed via standard protocols. The implants were inserted beyond the root apex in the extraction sockets to achieve primary stability, and a one-stage surgical protocol was employed for soft-tissue healing. Postoperatively, all the patients were prescribed 600 mg ibuprofen (Brufen, Kahira Pharmaceuticals & Chemical Industries), three times a day for seven days, and 0.2% chlorhexidine digluconate (Curasept, Curadent Healthcare), twice a day for seven days.

A total of 588 implants (Bio3 Progressive, Bio3 Implants; length: 6.0–13.0 mm; diameter: 3.3–5.0 mm) were placed to a minimum insertion torque of 30–35 Ncm, 33 implants in the maxilla and 252 in the mandible. Implant stability was measured using resonance frequency analysis (Osstell Mentor, Osstell) immediately after implant placement and after three to five months, just before fixation of the definitive prostheses. At the 36- and 60-month examination, all the prostheses were removed to measure the implant stability quotient (ISQ) value again.

Directly after implant placement, digital scan bodies were seated for a digital impression. After 6 hours, provisional acrylic resin dentures were fitted in the oral cavity and fixated to temporary abutments. Owing to precise digital preoperative planning, the occlusion only required minor adjustment. The definitive restoration was performed three to five months after implantation using CAD/CAM-fabricated (NobelProcera Software, Nobel Biocare) complete metal–ceramic or zirconia prostheses. The prostheses were fix-

Fig. 5: Final abutments placed in the mandible. – **Fig. 6:** Final abutments placed in the maxilla. – **Fig. 7:** Complete metal–ceramic mandibular denture. – **Fig. 8:** Complete metal–ceramic maxillary denture. – **Fig. 9:** Both metal–ceramic dentures *in situ*.

ated with cement (HS Implant and Long-Term Temporary Cement, Henry Schein).

All the patients were recalled yearly for preventive examination to assess inflammation of the peri-implant tissue, marginal bone loss, and aesthetic and functional satisfaction of the patients. All these parameters were rechecked during the follow-up examinations. Patients were followed up at six-month intervals for 36 months and then at a 60-month final follow-up (Figs. 1–10).

Results

There were no complications during implant placement and immediately postoperatively, and no signs of infection around the implants were detected at the follow-up visits. Four weeks after implant placement, the soft tissue around all the implants was in a good condition, evidenced by its healthy colour and texture. After three to five months, the mean marginal bone loss was 0.29 mm. At 12 months, it was 0.94 mm, and after 36 months, it was 1.28 mm. At the 60-month follow-up, the mean bone loss was 1.42 mm (Table 1).

Time	3–5 months	12 months	36 months	60 months
Marginal bone loss	0.29	0.94	1.28	1.42

Table 1: Mean marginal bone loss (mm) over time.

For the 588 implants, the mean resonance frequency analysis was 63.7 ISQ at implant insertion, and 72.4 ISQ after three to five months. At the 36- and 60-month follow-up, these values were 75.1 ISQ (512 implants were measured) and 76.3 ISQ (499 implants were measured), respectively (Table 2).

Time	3–5 months	12 months	36 months	60 months
ISQ value	63.7	72.4	75.1	76.3

Table 2: Mean resonance frequency analysis (ISQ value) over time.

The cumulative success rate of the implants after five years was 96.3% (based on 409 out of the initial 588 implants). Almost all the patients were completely satisfied with the functional and aesthetic results of the prosthetic rehabilitation: their masticatory function was restored, and their facial profile aesthetics and occlusion were improved.

Discussion

Evaluating the long-term results of immediate implant placement, the fourth ITI Consensus Conference stated that immediate implantation is a more complex technique compared with delayed implant placement. The survival rates of immediately placed implants are however high and comparable to those of implants placed according to

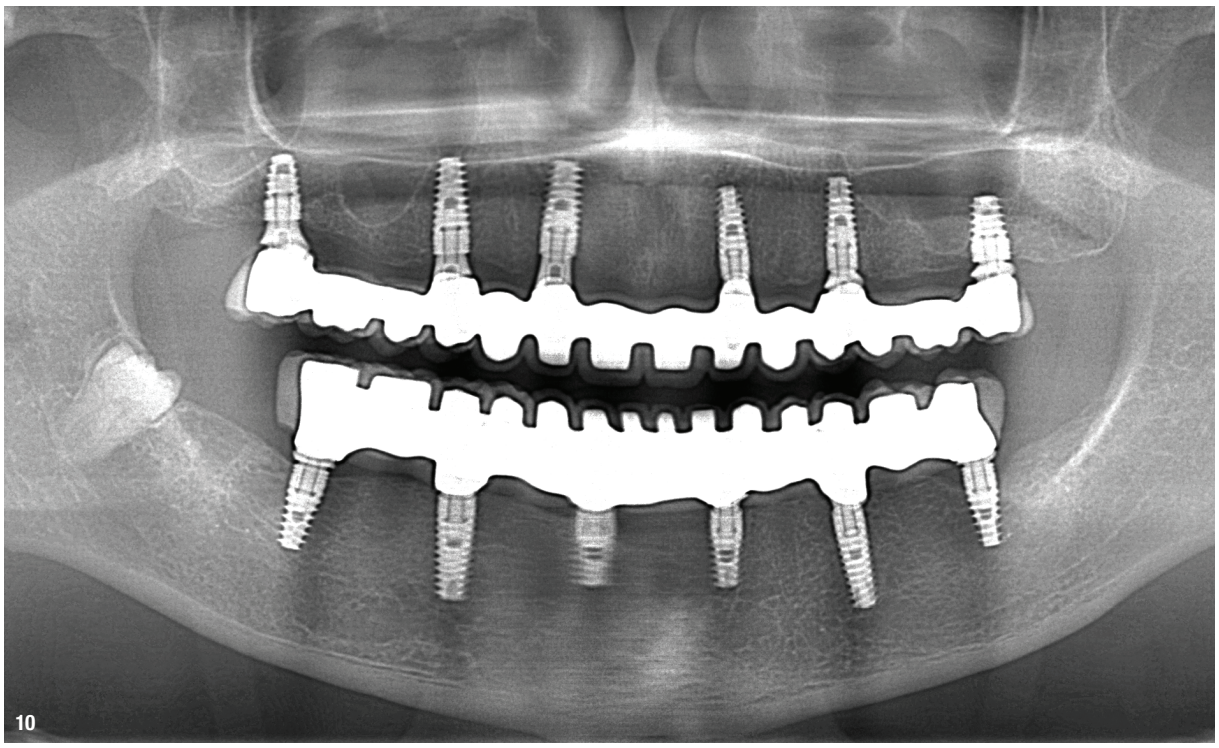


Fig. 10: Radiographic examination five years after placement and restoration of the implants.

a delayed protocol.[30] According to the seventh European Workshop on Periodontology, patients with severe periodontitis have a higher risk of complications and peri-implant infection.[31]

Recently, there have been a significant number of clinical studies and systematic reviews that have drawn positive conclusions regarding immediate placement and occlusal loading of implants. This protocol has shown a similar level of implant survival to that of the delayed loading protocol, which is considered a very predictable procedure.[32] The effectiveness of this treatment protocol depends on several factors: patient selection, bone quality and quantity, implant quantity and design, and implant primary stability. The employment of immediate occlusal loading protocols using full-arch fixed prostheses has many advantages: prevention of resorption of the residual alveolar ridge, reduction in the number of surgical interventions, reduction of treatment time, and improvement of aesthetics and occlusal function.[33]

There is only limited long-term data on immediate placement and occlusal loading of full-arch implants in periodontally compromised patients.[34] In published reports, implants in patients with periodontitis showed lower implant survival rates, higher marginal bone loss and an increased incidence of peri-implantitis compared with patients without a history of periodontitis. A recent clinical study of 58 patients with periodontitis over a longer period (ten years or longer) showed an implant failure rate of 10.08%.[35]

Studies have shown that, in patients with advanced periodontal disease, the clinical protocol of implant placement after tooth extraction and immediate occlusal loading is a predictable solution for prosthetic rehabilitation of the jaw, resulting in reduced treatment time. However, longer-term studies on a larger number of patients are needed to evaluate the effectiveness of immediate implant placement and delayed occlusal loading.

Immediate implant placement and immediate occlusal loading is a reliable treatment option for cases requiring early restoration of teeth to be extracted if all criteria for primary implant stability and occlusal adjustment of the provisional restoration are met. Immediate placement and loading preserves the vertical bone height and maintains the gingival architecture. After rehabilitation with implants, masticatory function, aesthetics of the facial profile and occlusion are improved. Patients expressed their satisfaction with the results of the therapy and their improved quality of life.[36]

Conclusion

Careful patient selection, a proper treatment plan and thorough follow-up of surgical and prosthetic protocols are key to success. Immediate implant placement saves time, involves less-invasive surgical procedures and can offer a good aesthetic outcome and success rate.

Based on the results of this report, it can be concluded that immediate implant placement may be a favourable treatment option if there is sufficient keratinised gingival tissue and sufficient bone volume around the extracted tooth. Absence of acute inflammation in the socket of the extracted tooth and good primary stability of the implant are essential. Effective supportive therapy is crucial for the successful outcome of this approach.

Prof. Curd Bollen

Literature

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