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Immediate Maxillary Lateral Incisor Implants with Nonocclusal Loading Provisional Crowns

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Abstract

This clinical report series describes a treatment modality involving immediately placed dental implants in maxillary lateral incisor sites using noncemented immediate provisional crowns retained with calcinable copings (prosthetic complement used in preparing the metal for the definitive prosthesis). Ten implants were placed in eight patients for the replacement of maxillary lateral incisors: two immediate and eight corresponding to cases of agenesis. All were subjected to immediate rehabilitation with provisional acrylic resin crowns in nonocclusal loading. One implant failed 3 weeks after placement due to acute local trauma. The other nine remained functional within the mouth, with normal clinical and radiological characteristics after a minimum of 12-month follow-up. Immediate placement of implant fixed provisional restorations retained by friction in maxillary lateral incisors offers an esthetic solution, eliminates the need for a removable provisional restoration, and avoids implant failures associated with excess cement or screw loosening. Moreover, in the case of extractions, immediate placement and provisionalization of implants in maxillary lateral incisors can effectively optimize the peri-implant esthetic results by maintaining the existing hard and soft tissue architecture of the replaced tooth. As no cement or screws are required, and the provisional crowns are placed in nonocclusal loading, the risk of complications is minimized.

Implant rehabilitation in the anterior sector of the maxilla with immediate nonloaded provisional crowns shortens the duration of treatment and offers acceptable immediate esthetic results.[1–4] Both cement- and screw-retained restorations have been used to restore implants immediately postinsertion.[5,6] In the case of cement-retained crowns, excess cement at the time of crown placement can give rise to complications such as peri-implant inflammation, bleeding, and even implant loss.[5] When screw-retained crowns are used, screw loosening can cause complications such as plaque accumulation, the growth of granulation tissue between the implant and provisional crown, fistula formation, or even screw fracture.[5,6] The overall survival rates in immediate nonocclusal loading of single-unit dental implants are similar to those obtained with traditional one- or two-stage surgical, unloaded healing protocols.[7–10]

In some cases of congenital partial anodontia, correct implant positioning with good esthetic results requires either orthodontic treatment to obtain sufficient mesiodistal space[11,12] or the use of mini-implant placement.[13]

The purpose of present clinical pilot study was to describe a new technique for implant placement in maxillary lateral incisors with immediate nonloaded provisional crowns retained by friction, not cement. This new technique offers an esthetic result and eliminates the need for a removable provisional restoration.

Case series

This study included eight patients (two males and six females) with a mean age of 28.5 years (range 17 to 61 years) missing maxillary lateral incisors secondary to agenesis of these teeth (unilateral in four patients and bilateral in two) or secondary to nonrestorable fractured teeth (two patients). In two cases where the mesial/distal spaces measured less than 6 mm, orthodontic treatment was provided until this minimum distance was achieved. All patients included in the study had a Silness and Loe[14] Gingival Index (GI) and Plaque Index (PI) of zero (absence of plaque and inflammation) and the absence of parafunctional habits. Ten solid, threaded Defcon®

Table 1 Characteristics of the patients and immediate implant positions

Case	Age	Sex	Tooth	Length (mm)	Diameter (mm)	Cause of extraction	Failure	Control (months)	Mesial bone loss	Distal bone loss
1	21	M	12	14.5	4.20	Agenesis	No	30	0.23	0.35
			22	16	4.20					
2	61	F	12	16	4.20	Fracture	No	24	0.72	0.65
3	19	F	12	13	3.60	Agenesis	No	24	0.41	0.67
			22	13	3.60					
4	17	F	12	16	3.60	Agenesis	No	24	0.56	0.78
5	35	F	12	16	3.60	Fracture	No	16	0.59	0.77
6	20	M	22	16	3.60	Agenesis	Yes	—	—	—
7	32	F	12	13	3.60	Agenesis	No	24	0.63	0.75
8	23	F	22	14.5	3.60	Agenesis	No	16	0.57	0.76

(Impladent, Sentmenat, Barcelona, Spain) titanium surface acid, Avantblast® surface implants measuring 13 to 16 mm in length and 3.60 or 4.20 mm in diameter were placed (Table 1). All implants were required to have insertion torque values above 35 Ncm, and resonance frequency analysis (RFA) values above 60 implant stability quotient measured with the Ostell™ instrument (Ostell/Integration Diagnostics, Göteborg, Sweden): the rigidity of the bone/implant interface is calculated from a resonance frequency as a reaction to oscillations exerted onto the implant/bone system (Fig 1).

For the two patients with fractured, nonrestorable maxillary lateral incisors, extractions were carried out preserving as much facial alveolar bone as possible. In these cases, no incisions were made, and careful curettage of the residual socket was carried out. In the cases of agenesis of the lateral incisors, a palatal incision was made with two minimal mesial and distal releasing incisions, preserving the interdental papillae in all cases (Fig 2).[15] The implant sites were prepared using the conventional rotary technique combined with the Summers' osteotome technique (Fig 3).[16] In the extraction cases, osteotomies were modified according to the anatomy of the sockets and were prepared palatal to them to ensure primary stability.[15] In all cases, the implant restorative platforms were approximately 2 mm apical to the cementoenamel junctions of the adjacent teeth (Fig 4).

In Case 5, a distance of 2 mm remained between the implant and the postextraction socket. This space was filled with bone shavings obtained from curettage of the bed, and the papillae were sutured.

Following surgery, control periapical digital RVG® Ultimate radiographs (Trophy®, Kodak Dental System, Atlanta, GA) and extraoral digital panoramic X-ray images (Orthopantomograph® OP100D, Instrumentarium Imagin®, Tuusula, Finland) were obtained.

All patients were restored with immediate nonocclusal loaded provisional crowns (immediate retorations): occlusal centric and eccentric contacts were not permitted on the provisional restorations,[7] and the prostheses were left 1 to 2 mm short of occlusal contact.[8] Occlusion was evaluated and modified with the patients seated in both the upright and reclined positions.[9] For preparation of the provisional crowns, the Pro-Unic® post (Defcon®) was positioned, with adaptation of the friction-retained calcinable coping (Fig 5). The retained calcinable coping was trimmed over the occlusal portion of the abutment, and a series of small perforations were made. A preformed crown (3M ESPE, Minneapolis, MN) was filled with autopolymerizing acrylic resin (Structur 2®, Voco, Cuxhaven, Germany) and placed over the calcinable coping (Fig 6). Following resin polymerization, the preformed crowns were removed. The excess was trimmed, and shaping was carried out to obtain optimal subgingival emergence profiles, prior to final polishing with a laboratory polisher drill (Komet®, Gebr. Brasseler, Stuttgart, Germany).

The provisional crowns were retained on the implants by the retention provided by the calcinable copings (15 Ncm). The junction between the calcinable coping and the acrylic resin is a mechanical junction resulting from the small perforations made in the calcinable coping. The crowns were relieved of both centric and eccentric movement occlusal contacts. Tarnow's recommendations[17] were followed to achieve interdental papilla formation, creating a contact point 5 mm or less from the alveolar crest. In the cases of extraction, any detached papillae received two sutures with nonabsorbable braided silk 4/0 (Lorca-Marin®, Murcia, Spain). All patients were advised to follow a soft diet during the first 4 weeks, taking care to avoid chewing on the implants. Oral hygiene was limited to brushing around the implants with a soft toothbrush for the first 2 weeks. Thereafter, conventional brushing and flossing were permitted. Patients were encouraged to rinse with 0.12% chlorhexidine, three times a day, during the first week post surgery.

Patients were scheduled for the first follow-up visit within 7 days of surgery, and again at 1 and 2 months post surgery. Occlusion, gingival margin, esthetics, and oral hygiene were evaluated at each follow-up appointment. The provisional restorations and abutments were removed approximately 8 weeks after implant placement, and implant stability was measured with the Ostell®. All values were above 60. Four months post surgical placement, impressions were made directly on the implants, and definitive crowns were cemented (Figs 7–8).

Degree of satisfaction

Using a 10-point visual analog scale (VAS), the patients were asked about the degree of satisfaction with both the provisional and definitive restoration esthetic outcome. The measurements were used to assess general satisfaction with the stability,

Figure 1 (Case 5) Only patients with RFA values (measured with Ostell®) above 60 were included in the study.

comfort, cleaning, and esthetics. The anchor words were "thoroughly dissatisfied" and "completely satisfied." The subjects were asked to draw a vertical line at the point on the horizontal line which best represented their response.

Figure 2 (Case 3) Palatalized incision and two minimum mesial and distal releasing incisions.

Figure 3 (Case 2) Preparation of the implant bed with osteodilators following extraction of the lateral incisor.

Radiographic evaluation

To reproduce the patient's alignment, a rigid, cross-arch bar was used with bite-registration material and a Rinn® XCP (Dentsply®, Arlington Heights, IL) rod and ring were firmly attached to the bar and were placed in contact with the X-ray cone. The receptor was held by a slot in the bar. Digital periapical RVG® Ultimate radiographs (Trophy®) were obtained 12, 18, and 24 months after implant placement. Implants were considered osseointegrated if they were clinically stable, showed no signs of infection, and if there was less than 1.0 mm of radiographic peri-implant bone loss at 12 months of follow-up. Peri-implant bone loss was measured from the periapical digital radiographs, measuring the mesial and distal implant bone loss at the time of placement and after 1 year. The height of lost bone, mesial and distal, was obtained by calculating the difference between the first and second measurement. The general

Figure 4 (Case 5) Implant positioned in 1.2.

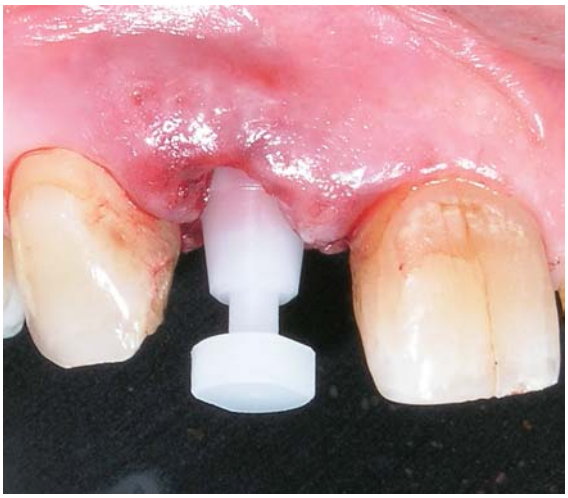

Figure 5 (Case 5) A calcinable coping was adjusted over the abutment post.

implant bone loss was taken as the greater of either the mesial or distal figures.

Outcome

All implants remained in the mouth with no clinical or radiographic alterations during the osseointegration period (8 weeks), with the exception of a single implant (Case 6) that failed 3 weeks after implantation due to acute occlusal trauma (biting on hard food). In this instance, a new implant was placed 4 weeks later. This implant was without a provisional restoration. Definitive implant restoration was carried out 2 months later. All patients reported a high degree of satisfaction with the esthetics, comfort, stability, and cleaning results of the provisional and definitive restoration (VAS scores between 7 and 10).

At 12 months of follow-up, digital periapical radiographs demonstrated a peri-implant mean bone loss of 0.53 mm on the mesial surfaces (range 0.23 to 0.72 mm) versus 0.68 on the distal surfaces (range 0.35 to 0.78 mm), in the nine implants that remained in the mouth. They were considered osseointegrated.

Figure 6 (Case 5) Trimming of the occlusal portion of the calcinable coping and adaptation of a preformed resin crown topped with autopolymerizing acrylic resin.

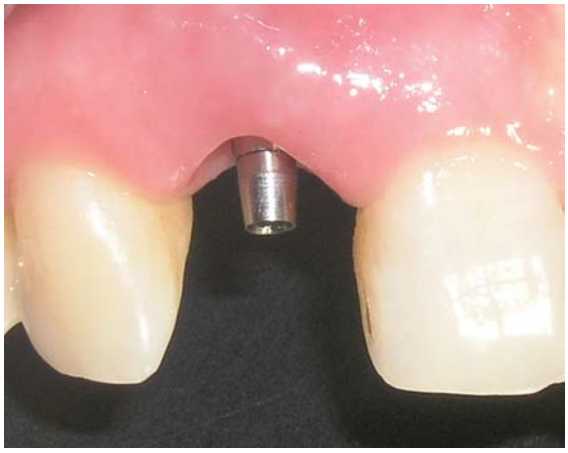

Figure 7 (Case 5) Peri-implant tissues 3 months after positioning of the provisional restoration and placement of the definitive abutment.

Discussion

Immediate nonocclusal loaded provisional crowns in maxillary lateral incisors can be screwed or cemented in place immediately after placement. These restorations should not have any occlusal contacts in centric or eccentric mandibular movements. This is important both for the biology of osseointegration and for the biomechanics of successful crown

Figure 8 (Case 5) Intraoral clinical view after cementing of the definitive crown. Note the good condition of the peri-implant tissues.

restorations. Screw loosening can be extremely problematic and may cause complications such as micromovements and implant loss, plaque accumulation, the growth of granulation tissue between the implant and provisional crown, the formation of a fistula, or even screw fracture.[5,6]

Pauletto et al[5] described four implant failures associated with excess cement remaining after restoration. According to these authors, such excess cement can give rise to rapidly developing complications, such as inflammation and peri-implant pouches, bleeding, and even implant loss. To avoid these problems, immediate provisional crowns retained with calcinable copings were used. It is important to polish the immediate provisional restorations and ensure optimal adaptation to the implants.

In some cases, correct implant positioning with good esthetic results requires orthodontic treatment to obtain sufficient mesiodistal space and correct alignment of the roots of the adjacent teeth.[11,12] Richardson and Russell[11] recommend a minimum space of 6 mm for lateral incisor crown replacement. In the present study, two cases of partial anodontia of the maxillary lateral incisors received orthodontic treatment until the required 6 mm of space was achieved. Other authors, such as Vigolo et al,[13] have resolved the problem of space by resorting to mini-implant placement. They reported a series of 52 mini-implants measuring 2.9 mm in diameter supporting single-tooth restorations. Their report illustrated implant placement in areas of limited space without resorting to orthodontic treatment. The resulting success rate was 94.2%.

In the cases of extraction, sufficient primary stability was achieved using implants with a diameter (3.6 mm) greater than that of the socket, and with greater length (between 13 and 16 mm).[2] All implants used in this study had insertion torque values above 35 Ncm, and Ostell® values above 60. Drago and Lazzara[9] studied the survival rates for implants restored with fixed provisional crowns without occlusion immediately after placement. To obtain adequate primary stability, the implants had to achieve initial torque values of at least 30 Ncm. The authors reported an overall survival rate of 97.4%, and an average bone loss of 0.76 mm after 18 months of follow-up. The provisional crowns were positioned in nonocclusal loading, to avoid exposure to occlusal forces.

In all cases, the use of plastic copings allowed crown retention without the need for cement. In this study, implant rehabilitation of maxillary lateral incisors with immediate crown replacement in nonocclusal loading afforded good results and an important degree of patient satisfaction. Because the maxillary lateral incisors receive the lowest occlusal load, this technique has only been applied in maxillary lateral incisors. In fact, further studies with larger sample sizes are required to evaluate the long-term outcomes and to provide a conclusion on all anterior single implants such as the maxillary central incisors and mandibular incisors.

Conclusions

Immediate placement of implant fixed provisional restorations retained by friction in maxillary lateral incisors offers an esthetic solution, eliminates the need for a removable provisional restoration, and avoids implant failures associated with excess cement or screw loosening. Moreover, in the case of extractions, immediate placement and provisionalization of these implants can effectively optimize the peri-implant esthetic results by maintaining the existing hard and soft architecture of the replaced tooth. As no cement or screws are required, and the provisional crowns are placed in nonocclusal loading, the risk of complications is minimized.

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