Case Presentations and Evolution in Concepts of Immediate Loading in Edentulous Mandible

Keywords: Immediate loading; Splinting of implants; Paralleling guide; Optimal position; Angulation of implants

Abstract

The purpose of this case series is to demonstrate an innovative paralleling device and a step by step surgical and prosthetic approach for achieving buccolingual and mesiodistal parallelism of immediately loaded implants. Clinical outcomes including success rates, indications, advantages, complications and limitations of this technique in cases using an Immediate Loading (IL) protocol will be discussed. Thirteen consecutive cases from the database that were treated with an IL protocol utilizing a paralleling device were included in this study. The treatment sites included the interforaminal area in 8 totally edentulous and 5 partially edentulous mandibles. In this case series the average survival rate was 98.4% with a loading period of 6-28 months. There was one implant failure, one provisional restoration fractured and two cases with cement wash out during the follow-up period. Results of this case series demonstrated that implant placement in optimal position and angulation using the suggested IL protocol and paralleling device produces predictable results. It is also simpler, faster and more cost effective than the screw retained protocol.

Introduction

Increasing patient’s expectations and the need for a fixed dentition during implant treatment led to the development of implant immediate loading procedures with provisional fixed prostheses [1-4]. The benefits of immediate implant loading include the restoration of esthetics, improving self-esteem, shortening treatment times, eliminating issues arising from the use of removable prostheses and a more rapid post-operative functional recovery [5]. Subsequently, there is gradual reincorporation of a normal diet with a more balanced nutrition.

In 1985, Schroeder introduced a single stage approach with TPS implants in which the coronal part of the one piece solid implant was placed slightly supramucosally, led to predictable clinical results [6]. Ericsson et al were among the first to show that turned implants could osseointegrate equally well with a one-stage approach in the interforaminal area of the mandible without jeopardizing bone remodeling [7]. Even after 5 years in function, implant survival and bone remodelling were comparable in the anterior mandible [8].

Several investigators thereafter, documented high success rates with the use of immediate and early loaded implants supporting full-arch fixed restorations in the mandible [9-13]. Immediate loading results for such restorations are dependent on the number of implants, the type of prosthesis, the presence or absence of splinting, the occlusal scheme, and the jaw being restored [14]. The use of immediate loading of splinted implants to restore edentulous arches has been documented. Tarnow et al. published their experiences with the immediate loading of edentulous arches in 10 patients [3]. The group placed 107 implants, 50 of which were immediately loaded. Two failures were recorded in the mandible of the experimental group. The authors attributed the failures to removal of the provisional prostheses for evaluation of implant healing. Tarnow et al proposed that cross-arch stabilization should be attempted in edentulous arches by splinting the implants by using a single provisional restoration. In addition, they also recommended leaving the provisional intra-orally at least two months post placement.

Despite following these guidelines, immediate loading still remains a technique sensitive procedure which requires precise implant placement and fabrication of an accurate provisional restoration for loading the implants. This is especially challenging in the mandibular anterior region where the arch’s curvature is greatest and the alveolar crest is often uneven. Therefore various techniques have been introduced to make this procedure less technique sensitive, less time consuming, more accurate and more predictable. These included computer guided surgery, laboratory processed provisional, use of an Omnivac shell to fabricate cement retained provisional, use of angled abutments and use of temporary abutments to adjust the angulation during provisionalization [3,15]. These techniques are either expensive or time consuming yet not predictable. The latter of these techniques would not be necessary if implants were placed in optimal position and angulation with proper interimplant distance.

The purpose of this case series is to introduce an innovative technique that is cost effective, fast and predictable. A paralleling device and step by step guide for surgical and prosthetic rehabilitation approach with cement retained restoration for achieving buccolingual and mesiodistal parallelism of immediately loaded implants is demonstrated. Clinical outcomes including success rates, indications, advantages, complications, and limitations of this technique in cases using an immediate loading protocol will be discussed.

Materials and Methods

Clinical data in this study was obtained from the Implant Database (ID). This data was extracted as de-identified information from the routine treatment of patients at the Ashman Department of Periodontology and Implant Dentistry, New York University, USA.

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Periodontology and Implant Dentistry at the New York University College of Dentistry (NYUCD) Kriser Dental Center. The ID was certified by the Office of Quality Assurance at NYUCD. This study is in compliance with the Health Insurance Portability and Accountability Act (HIPAA) requirements and approved by the University Committee on activities involving human subjects.

Thirteen consecutive cases from the database that were treated with an IL protocol utilizing the paralleling device were included in this study.

**Patient inclusion criteria:** All of the included patients had:

1) A total of 3-6 implants placed and immediately loaded on the same day of the surgery with a chair-side provisional restoration.

2) Totally edentulous mandible or partially edentulous mandible with more than 5 teeth that required extraction in the anterior mandible due to periodontal disease, fracture or failure of endodontic treatment.

3) An adequate anterior-posterior (A-P) spread that was present in the lower arch.

4) The treatment sites were limited to the interforamina area. A total of 9 edentulous and 5 partially edentulous mandibular cases were selected to be included in the study.

5) All cases need to be treated with same technique steps and device.

**Patient exclusion criteria:** All patients that were excluded from the study had:

1) Systemic diseases that could alter the tissue integration of dental implants.

2) Generalized active periodontal disease or active periapical infection in the remaining teeth.

3) Parafunctional habits.

4) Lack of compliance.

5) Bone grafts at the time of placement

**Clinical procedures:** A set protocol was established, standardized and applied to all 14 patients as follows;

1) Clinical and radiographic examinations were made (Figures 1-5).

2) Pre-surgical steps - Stereolithographic model is printed using the CBCT scan of the edentulous mandibular arch (Figure 6). Vacuum form shells and resin shells fabricated from an ideal wax up or pre-existing denture, and a bite registration on the occlusal surface of the shell with pattern resin (GC corporation, Tokyo, Japan) to evaluate the vertical dimension of occlusion.

3) Subjects took 2 g Amoxicillin (TEVA, USA) 1 hour prior to surgery and in those allergic to Penicillin, 600 mg of Clindamycin (Pharmaderm, Princeton, NJ) was given.

4) Mid-crestal and when necessary vertical incisions were made after local anesthesia infiltration (2% Lidocaine 1:100,000 epinephrine [Henry Schein USA]).
5) Atraumatic tooth extraction took place in cases where immediate implant placement was performed.

6) Full thickness mucoperiosteal flaps were reflected.

7) Alveoloplasty was performed in cases where the alveolar ridge required contouring using dental bur.

8) A total of 3-6 implants were placed in each mandible using an adjustable paralleling device. The implant placement utilizing an IL protocol featuring implant surfaces with either a Resorbable Blast Media (RBM), 4.0 mm or Sandblasted, Large grit, Acid-etched (SLA) surface in the endosseous portion (Figure 7). A crestally widened implant platform diameter of 4.8 mm, a body diameter of 3.3 or 4.1 mm and a length of 12 or 13 mm (Sybron XRT, Orange, CA, Straumann Standard Plus, Basel, Switzerland Nobel Biocare Branemark MkIII TiUnite, Balsberg, Switzerland) were used. Primary stability of each implant was achieved by undersizing the osteotomy and engaging a widened crestal platform of the implant with the cortical bone. This meant that the 2 different types of implants were placed differently. The RBM surfaced implants with the micro thread up to the platform were placed evenly with the crestal bone. The SLA surfaced implants were placed 2 mm more apical than the roughened surface in order to engage the widened neck with the crestal bone. Primary stability of more than 30 Ncm was confirmed for each placement using a torque driver.

9) The narrow diameter abutments (platform switching concept) were connected at a torque of more than 30 Ncm and wound closure was achieved using 4.0 resorbable sutures (Vicryl Ethicon).

10) A fixed provisional restoration was fabricated chair-side for cross-arch stabilization. The Omnivac shell or resin shell was mounted to verify that the abutment fit in the template. Prefabricated plastic copings were placed on the abutments and a self-curing acrylic resin or Bis-acryl Luxatemp (DMG, Hamburg, Germany) was then injected into the template (Figure 10). The template was seated with bite registration and guidance from adjacent teeth and/or the opposite jaw, and allowed to set for 4 minutes while the patient was biting in maximum intercuspation. After the temporary prosthesis was removed from the abutment, excess material was trimmed outside the mouth and occlusal adjustments were made.

11) The provisional restoration was cemented with Polycarboxylic cement (Durelon 3M ESPE, Norristown, PA) and all implants...
were immediately loaded in function (Figures 11 and 12).

12) The patient presented for postoperative care at 1 week, 2 weeks and then once every month following implant placement to monitor oral hygiene, mucosal healing, the stability of the provisional bridge, and fixture status. The patients were instructed to follow a soft diet for 6-8 weeks after surgery. Each patient was prescribed antibiotics (Amoxicillin 500 mg TID or Clindamycin 150 mg QID) and Chlorhexidine gluconate for 1 week following the surgery (Figure 13).

13) The provisional prosthesis was not removed to avoid an excess of micro movement until the healing period was completed. Follow up panoramic radiographs were taken.

14) After 3 months of healing period, the provisional restoration was removed to evaluate implant mobility and periimplant soft tissue.

15) The definitive prosthesis was fabricated after a final impression was obtained 3-6 months after implant placement.

Results

In this case series the average survival rate was 98.4% with a loading period of 6-28 months. Out of thirteen patients, twelve demonstrated 100% implant success rate. Only one implant failed in a patient whom received 5 implants with immediate placement. One provisional restoration fractured and two cases with cement wash out during the follow-up period (Table 1).

Discussion

The immediate loading (IL) of implant-supported fixed prostheses is clinically well documented with a reported 85.7-100% implant survival rate in the edentulous mandible [15]. Immediate loading of immediately placed implant has also shown a high success rate of 97.7-100% comparable to immediate loading of two stage implant as long as primary stability achieved [10,16,17]. The results of the present study indicate similar implant survival rates [18]. In this case series, a total of 63 implants were placed in 13 patients using the paralleling device and all immediately loaded. The average survival rate was 98.4% with a loading period of 6-28 months. Primary stability of more than 30 Ncm of torque was achieved by under-sizing the osteotomy and engaging the widened crestal platform of the implant with the cortical bone. There was one implant failure. This implant was placed immediately after extraction. Authors believe the failure was due to minimum primary stability and micromotion.

Other critical factors for implant success are achieving optimal implant position and angulation from next page. Creating a flat bony contour is the initial step to establish optimal implant position and angulation as well as to define anatomy to maximize implant fixation for immediate load prosthesis [19]. This osteoplasty creates a flat contour on which the restoration is placed. The plat contour serves multiple functions for both the surgeon and the prosthodontist. That include:

1. Establishing prosthetic restorative space.
2. Establishing a level alveolar plane and uniform implant levels.
3. Establishing alveolar width for implant diameter selection.
5. Helps to establish arch form, implant distribution and

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PE: Partial Edentulous; TE: Total Edentulous; NT: Natural Teeth; FP: Fixed Prosthesis; RP: Removable Prosthesis; NT/FP: Natural Teeth/Fixed prosthesis combination
Surgical guides that are made custom based can add to the cost of can be achieved using a surgical guide or the paralleling device. Adverse directions can impair the esthetics mesiodistal and buccolingual parallelism during implant placement approach to the implant placement. Surgeon to see the bone structure on a two-dimensional screen, 3D software. Furthermore, while computer planning only allows the user-friendly among craniofacial surgeons and highly reliable multiunit abutments on the same day of surgery. In addition to the benefits to the patients, 3D modeling is viewed as being particularly user-friendly among craniofacial surgeons and highly reliable and accurate [22,23]. Three-dimensional modeling in contrast to computer planning of implant surgery does not require specific software. Furthermore, while computer planning only allows the surgeon to see the bone structure on a two-dimensional screen, 3D models enable the surgeon to physically examine the bone structure at all angles and use this information to formulate a step-by-step approach to the implant placement.

When the position of the implant has been identified, the direction/inclination of the implant must be determined. Establishing mesiodistal and buccolingual parallelism during implant placement is an important step. Adverse directions can impair the esthetics and function of the future restoration. Mesiodistal parallelism can be achieved using a surgical guide or the paralleling device. Surgical guides that are made custom based can add to the cost of the technique and their insertion require extra step. The paralleling device introduced here can be reused after sterilization, makes the technique more simple and cost effective.

It has been reported that the critical factors for successful IL are implant stability upon insertion and cross arch splinting via a rigid implant supported bridge to decrease micromotion less than 50-150 nm at the bone-implant interface [24]. If three or more implants are placed in a tripod or a cross-arch configuration, splinting a provisional bridge as soon as possible after implant placement reduces lateral forces on implants and allows more favorable axial forces [3,25,26].

Temporization in IL can be accomplished using different techniques. These include use of an Omnivac shell to prepare chairside cement retained provisional, use of a premade resin shell to fabricate a cement-retained provisional, use of lab processed provisional or conversion of an existing denture into a screw-retained provisional [18]. Since the late 1990’s, cement-retained restorations have been the preferred method with high success rates while aiding IL restorative time reduction [19,27]. Screw-retained restorations are more technique sensitive and time consuming when fabricated chairside. Moreover, cost is increased due to the additional laboratory and clinical components, and it is difficult to obtain non-passive bridgework [28]. Parallel alignment avoids use of angled abutment or abutment adjustment [29]. Bony stress is concentrated in the cervical area of an implant, therefore cervical cortical bone serves as the major anchoring point for an implant [3,29]. Parallel implant placement also reduces the stresses at the implant and bone interface since the implant does not have a PDL which acts as a shock absorber in teeth. A midline guide pin and a paralleling device may be used to obtain good parallelism. Other factors for successful provisionalization with an IL protocol include careful cementation. Permanent cementation is recommended because the prosthesis must remain fixed during the first 8 to 12 weeks post-surgically otherwise implant stability and osseointegration may be compromised. Additional care must be taken to limit cement extrusion beyond the abutment restoration margin and into the periimplant mucosal tissues because residual cement may cause inflammation and compromise bone and soft tissue healing [30].

Conclusion

Results of this case series demonstrated that implant placement in optimal position and angulation can be easily achieved using the suggested innovative immediate loading technique using paralleling device producing predictable results. Employing a cement retained provisional restoration with this technique is simpler, faster and more cost effective than the screw-retained protocol. Nevertheless, future prospective studies with long-term follow-up and an increased number of cases are necessary to further evaluate this technique.

References

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