Success of Unsplinted Implant-Retained Removable Mandibular and Maxillary Overdentures: A Retrospective Study of Consecutive Cases

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Implant-retained overdentures have been provided on both splinted and freestanding implants. For the mandible, a long history shows that both approaches can be successful over the long term. For the maxilla, many clinicians prefer to splint the implants because of concerns about softer bone quality and insufficient data supporting the use of freestanding overdenture abutments. However, a few investigations have found survival rates for unsplinted maxillary overdentures to be comparable to those for splinted ones. The present study analyzed records of consecutive patients who were treated with unsplinted maxillary and mandibular overdentures and followed for 4 to 107 months. A total of 31 overdentures were identified, 15 maxillary and 16 mandibular, supported by 129 implants. All the overdentures, along with all the implants, survived throughout the follow-up period. (Int J Periodontics Restorative Dent 2015;35:533–539. doi: 10.11607/prd.2233)

When restoring implants placed in the edentulous arch, treatment options include fixed cement- or screw-retained prostheses, fixed-detachable (hybrid) restorations, or removable overdentures that may be bar-retained (splinted) or retained using freestanding implants with resilient attachments (unsplinted). Unsplinted overdentures typically represent the least expensive option and are easiest to fabricate, while offering potential esthetic, phonetic, and maintenance advantages.1 Long-term function and survival of freestanding implants with attachments in the mandible are well established;2,3 although there has been an interest in applying the same treatment concept to the maxilla,4,5 this has not been supported by studies. A perception has persisted among dental clinicians that splinted removable overdentures provide a better structural support system than do unsplinted overdentures.

In the experience of the author, attachment-only, unsplinted overdentures have been successful for a number of patients. The present retrospective study was undertaken to examine the outcome of unsplinted maxillary and mandibular overdentures placed consecutively in patients beginning in 2004.

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Method and materials

Records in the author’s dental practice were examined to identify patients treated with unsplinted overdentures retained by a minimum of three implants in either one or both arches. Patients treated with unsplinted overdentures that were retained by only two implants were excluded. This occurred rarely, always in the mandible, and only when financial constraints allowed for no other alternatives.

The author and a surgical dentist collected a full health history and evaluated all patients. Smokers were not excluded. However, patients who admitted that they were actively smoking were strongly advised to significantly reduce or eliminate their smoking, if possible. Patients with diabetes controlled by diet or medication were treated, as were patients who had received bisphosphonate medication for osteoporosis, provided that such treatment lasted for less than 3 years and included only oral medication (not intravenous).

Treatment was provided either by a surgical specialist placing the implants or entirely by the author for both implant placement and restoration. The intention was to include implants of a minimum length of 10 mm for unsplinted overdentures. However, one patient presenting with 8-mm implants already in place that were clinically successful was included, as was one patient with two 10-mm implants and one 8-mm implant in the mandible. Three 10-mm implants were planned for the latter patient, but the oral surgeon substituted one 8-mm implant because of limited bone volume. Implant placement in type I or II bone was considered preferable, but some sites with type III bone were included. No exclusions were made on the basis of conditions in the opposing arch. Overdentures with unsplinted implants fulfilling the aforementioned criteria were an option regardless of whether they were opposing a bar or attachment overdenture, a fixed hybrid appliance, a conventional full denture, or natural dentition.

All implants had a roughened surface and were placed following the surgical drill sequence recommended by the implant manufacturer. Healing abutments were then connected immediately. The standard protocol called for placement of four implants to support the overdenture, followed by a 3- to 4-month healing period (Figs 1 and 2). During the healing period, patients used either their existing denture after it was modified with a soft liner or a new interim denture constructed with a soft liner applied to the intaglio surface.

After healing, the implants were torque tested to 35 Ncm to confirm stability, and prosthetic procedures were initiated to fabricate the definitive implant overdenture. In all cases, the overdentures were attached to either ERA (Sterngold) or Locator (Zest Anchors) abutments (Fig 3). All the overdentures, maxillary and mandibular, were constructed with a cast metal strengthening framework embedded into the denture base (Fig 4).

Data analysis

After receiving their definitive overdentures, all patients made recall visits according to a standard hygiene maintenance schedule. Panoramic radiographs were generally taken on an annual basis (Fig 5), and the abutments and prostheses were carefully examined for complications including erythema, inflammation, infection, purulence on palpation, implant mobility, abutment screw breakage or loosening.
abutment wear, denture base fracture, and denture tooth loss. Bone loss was assessed by comparing the patient’s initial panoramic radiographs with subsequent panoramic radiographs. It was recorded as either “none” (no observable loss of bone height around the implants), “minimal” (loss of up to two additional implant threads from the baseline), “moderate” (two to five threads of lost bone height), or “severe” (loss of more than five threads of bone height).

Records of the included patients were analyzed to identify such parameters as patients’ age and sex, length and diameter of the implants placed, type of attachment system used, complications, length of follow-up, and status of the overdenture at the time of the last follow-up appointment.

Survival

Overdenture survival consisted of the prosthesis continuing to function with no discomfort, no occlusal problems, satisfactory phonetics, and satisfactory esthetics while being supported by the original implants.

Success

Implants were considered to be successful if they were functional and clinically stable when tested individually, with no pain or mobility. The peri-implant soft tissues also had to be clinically healthy (defined as firm, pink gingival tissue with little or no bleeding on cleaning or probing). Radiographs could not demonstrate radiolucencies or moderate to severe bone loss.

Complications

Overdenture complications to be noted included denture base fracture, denture teeth fracture or loss, chronic soft tissue sore spots, poor occlusion, phonetic difficulties, and esthetic dissatisfaction with the overdenture appearance.

As a retrospective review of completed cases in one general practice, no control group was identified in this study.

Results

Analysis of the practice records identified 21 consecutive patients (12 women and 9 men) treated with a total of 31 unsplinted overdentures, supported by 129 implants. Fifteen overdentures were located in the maxilla, and 16 were mandibular. Ten patients (six women and four men) received overdentures in both arches. Most of the overdentures were supported by four implants (n = 22), but three mandibular overdentures were supported by three implants, four (one maxillary and three mandibular) were supported by five implants, and two (maxillary) were supported by six implants.

The vast majority of the implants placed (125 of 129; 96.9%)
were at least 10 mm long. Four 8-mm-long implants were included in the data. As described earlier, one patient presented before consultation with three 8-mm implants: two in the maxilla retained with four additional 10-mm implants, and one in the mandible supplemented by two additional 10-mm and two 16-mm implants. The other patient had a mandibular overdenture retained by one 8-mm-long and two 10-mm-long implants.

Although a minimum diameter of at least 4.3 mm was targeted for all patients, insufficient bone width required the placement of smaller-diameter implants at 39 sites (30.2%). These included 13 3.5-mm-diameter implants (2 maxillary and 11 mandibular), 20 3.8-mm-diameter implants (11 maxillary and 9 mandibular), and 6 4.0-mm-diameter implants (2 maxillary and 4 mandibular). Table 1 displays the length, diameter, type, and distribution of all maxillary implants included in the study.

Implants were placed in fresh extraction sockets in only one patient (who received three 4.3-mm-diameter implants, placed in the mandible). That was also the only case with immediate engagement of the Locator abutments to retain the overdenture.

Of the 21 patients included in the study, 4 were lost to follow-up after intervals that ranged from 4 to 65 months. The average follow-up period for all 31 overdentures was 56.5 months.

No implants were lost throughout the follow-up period. “Minimal” and “moderate” bone loss was found at two sites each (1.6% each). No “severe” bone loss was recorded around any implant. No overdenture failures were recorded throughout the follow-up period. All original prostheses continued to function with stability, retention during function, and patient satisfaction with occlusion, phonetics, and esthetics.

Table 1

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*FDI system. All implants Replace Tapered (Nobel Biocare) unless otherwise noted. `Core-Vent implants; Steri-Oss Mini Series non-hexed implants.

Table 2

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Complications were minor, including some gingival irritation and some minor occlusal adjustments. Seven patients (33%) required replacement of one or more denture teeth. Of the 129 overdentures, 19 separate incidents of these complications were recorded, all of which were resolved with minor adjustments or repairs. All overdentures met the criteria for survival and success. Table 2 illustrates the pertinent demographics and results of the study.

Discussion

Restoring implants with unsplinted overdentures offers patients a number of advantages. The cost is substantially lower, and less horizontal and vertical space may be needed for individual attachments than for bar structures, which may result in better esthetics. Phonetics also may be superior, and hygienic procedures are simpler. Studies have found better plaque and gingival index scores and less tissue hyperplasia around individual attachments compared with bar-splinted implants.6,7 For clinicians also, fabrication of unsplinted overdentures may be preferable, enabling the use of simpler impression techniques and facilitating attachment placement, maintenance, and repair.

Nonetheless, because of the aforementioned paucity of published support, many dentists are hesitant to provide unsplinted implant overdentures, particularly in the maxilla. It has been suggested that resistance to using them also may stem from previously reported problems that occurred when unsplinted maxillary overdentures were supported by short or machined-surface implants placed in poor bone. More contemporary textured-surface implants have demonstrated more bone-to-implant contact, even in poor-quality bone.8,9

Recently, more evidence has begun to emerge on the performance of unsplinted maxillary overdentures. One 2007 report on a case series of five patients who received unsplinted maxillary overdentures supported by roughened implants (placed in a two-stage protocol) found that all the implants were still functioning and marginal bone levels remained stable after 12 to 48 months.1 A recent retrospective analysis of a case series that included 84 anterior maxillary implants restored with Locator-retained overdentures reported a 98.8% maxillary implant survival rate after 32.9 months of follow-up.10 Another study comparing maxillary overdentures placed in 44 patients and supported by either telescopic crowns (n = 21) or bars (n = 23) found no significant differences in implant survival and success rates, average bone resorption, or patient satisfaction after 5 to 8 years of follow-up.11

Apart from the present study, very few studies have compared splinted vs unsplinted implant-supported maxillary and mandibular overdentures. A systematic literature review published in 201112 identified only two. One randomized, controlled trial included 26 patients who received 34 overdentures (10 maxillary and 24 mandibular) and found both ball and bar attachments to be reliable, with prosthetic complications distributed equally among them.13 The other was a prospective longitudinal study of 43 patients who received 50 overdentures (18 maxillary and 32 mandibular) randomly assigned to receive either a ball or bar attachment system. It found no differences in implant survival between the splinted and unsplinted systems.14 The literature review also concluded that unsplinted designs generally appeared to require more prosthetic maintenance, with exchange or activation of retentive clips or O-rings, renewal of magnets, and tightening of abutment screws being among the commonly reported complications. But it cautioned that more research on splinted and unsplinted maxillary overdentures was needed.
The successful performance of the unsplinted maxillary overdentures included in the present study may, at least in part, be attributable to the preoperative diagnosis and case selection process followed for these patients in a private dental practice. The decision of whether to offer restoration with an unsplinted overdenture depends on a series of technical factors, including the number of implants placed, implant size and angulation, interarch space, bone density, and hygiene maintenance factors.

On the rare occasions when patients were provided with unsplinted overdentures supported by only two implants, the author found that the overdentures frequently rotated around the fulcrum of the implants, creating a feeling of looseness and food collection that patients reported to be highly aggravating. In contrast, four implants provide bilateral retention and stability through resistance to rotation. Interestingly, the use of three implants may also provide sufficient retention to satisfy the patient during function, if the anteroposterior (A-P) spread is large enough.

The author has found the ideal placement schema for both maxillary and mandibular overdentures to be two implants in the canine sites and two in the first molar sites. In cases for which this was not possible because of insufficient maxillary bone quality and/or quantity, sinus-lift grafts could enable placement in the molar sites. If a patient declined a sinus-lift procedure under such circumstances, the implants were placed in more anterior positions, such as the lateral incisor and first or second premolar positions (Fig 6). Note that all freestanding implants used in the maxillary overdentures were planned for axial alignment; no attempt was made to gain additional posterior extension by tilting posterior maxillary implants.

Obtaining the maximum A-P spread is always a goal in implant placement. Having sufficient anterior-to-posterior space between implants provides a more stable support system and retentive capability for the overdenture compared with cases in which the separation is minimal. When two implants on one side of the arch are placed in the anterior region with only limited A-P spread, the posterior cantilever area can create more stress on the distalmost implant and more pressure on the posterior portion of the overdenture during function. Whether the implants are placed with ideal or compromised A-P spread, however, it is desirable to have them situated with as much parallelism as possible. The overdenture path of insertion can be more difficult to accomplish with highly divergent angulations among the implants, and wear of the overdenture abutment-retentive surfaces may be accelerated.

All but one of the final maxillary overdentures were designed with an open palate, which allows the patient to enjoy the taste and texture of various foods, greatly enhancing the experience of eat-
ing (Fig 7). Interestingly, one patient for whom an overdenture with full palatal coverage was fabricated required this design to achieve optimal phonetics. His speech sounded better with full palatal coverage than without it. A linguized occlusion format was incorporated in all overdentures whenever possible. In this design, the palatal cusps of the maxillary posterior denture teeth are in centric occlusion with the central fossae of the mandibular posterior surfaces, with minimal or no contact in excursive movements. The buccal cusps of maxillary and mandibular posterior denture teeth make no contact in centric relation, working or balancing excursions. This arrangement of the posterior occlusion minimizes lateral forces that could, over time, damage the implant abutments and/or implant to bone integration.15–17 Canine guidance was incorporated in lateral movements to exclude the posterior teeth (Fig 8). The patients and author approved the esthetic appearance of the overdentures, the occlusion, and the phonetics before processing the cases (Fig 9).

Conclusion

The results of this retrospective study confirm that unsplinted overdentures supported by three to six roughened implants that are at least 10 mm long can be a successful solution for many edentulous patients, including those requesting maxillary restoration. Prospective, controlled clinical studies involving larger groups of patients followed for a longer period are needed to confirm these results and explore how the conservative protocol used in the author’s practice may be modified and/or expanded to additional populations.

Acknowledgments

The author reported no conflicts of interest related to this study.

References