Multicenter Retrospective Study of Cement-Retained Implant-Supported Anterior Partial Prostheses: Success and Restoration Evaluation

Ameen Khraisat, BDS, PhD[1]/Sami E. Jebreen, DDS, MSc[2]/Zaid H. Baqain, BDS, FDSRCS (Eng), MSc[3]/Leena Smadi, BDS, MDentSci, FDS RCS (Ed)[4]/Lara Bakaeen, BDS, MSc[5]/Osama Abu-Hammad, BDS, PhD, MSc[6]

***Purpose**: The aim of this multicenter study was to evaluate implant success and restorative complications of cement-retained implant-supported anterior partial prostheses in Jordan. **Materials and Methods**: A retrospective study of all implants with a minimum of 1-year follow-up were used to support fixed, cement-retained restorations from April 2000 until March 2007. The cement-retained implants were loaded with either single- or multiple-tooth replacements. The Fisher exact test was performed to test the presence of any statistically significant difference in success concerning gender or arch of placement. **Results**: Eighty-seven implants were placed in the anterior region of the mandible or maxilla in 49 patients at multiple clinical practices in Jordan. The age of the patients ranged from 17 to 85 years. Eighteen implants were placed in the mandible and 69 in the maxilla. Three maxillary implants in 2 male patients had 3-mm horizontal bone loss. Those 3 implants are still functioning and were considered surviving implants but not successful implants. Therefore, the implant cumulative survival rate for both arches and genders was 100%. The implant cumulative success rate was 95.78%. Three crowns (maxillary) were dislodged. No significant differences were revealed regarding gender or arch of placement (P > .05). **Conclusions**: Cement-retained implants exhibited high survival and success rates among a Jordanian population.* Int J Oral Maxillofac Implants 2008;23:705–708

Key words: *cement, implant-supported prosthesis, restorative problems, success rate, survival rate*

The use of dental implants has become a successful procedure for the treatment of complete and partial edentulism.[1–5] The presence of teeth can complicate the oral environment in which the implant-supported prosthesis must function. Occlusal forces, tooth wear, and abrasion resistance, differences in resiliency between teeth and implants,[6] and microbiologic flora are major differences between partially and completely edentulous patients.[7]

It has been reported that in partial edentulism, the presence of adjacent teeth can help preserve the edentulous ridge width and height. This would be a major determining factor in the placement of the implants and esthetic outcome of the prosthesis.[8,9]

Recently a multicenter retrospective analysis of 675 implants for single-tooth replacement described a cumulative survival rate of 99.1% for all sites. This study compared 2 different methods of prosthesis retention, screw and cement retention. Cement-retained restorations showed a low incidence of complications (1.2 %).[4]

The aim of this retrospective multicenter study was to evaluate implant success and restorative complications for cement-retained implant-supported anterior partial prostheses used to restore patients from Jordan with a 1- to 6-year follow-up period.

[1]Assistant Professor, Department of Conservative Dentistry and Prosthodontics, Faculty of Dentistry, University of Amman, Jordan.
[2]Consultant in Prosthodontics, Dental Department, King Hussein Medical Center, Royal Medical Services, Amman, Jordan.
[3]Assistant Professor, Department of Oral Surgery, Oral Medicine, and Periodontology, Faculty of Dentistry, University of Amman, Jordan.
[4]Assistant Professor, Department of Conservative Dentistry and Prosthodontics, Faculty of Dentistry, University of Amman, Jordan.
[5]Private Practice and Part-Time Lecturer, Department of Conservative Dentistry and Prosthodontics, Faculty of Dentistry, University of Amman, Jordan.
[6]Professor, Department of Conservative Dentistry and Prosthodontics, Faculty of Dentistry, University of Amman, Jordan.

Correspondence to: Dr Ameen Khraisat, Salt P.O.B. 436, 19110 Jordan. Fax: +962 6 541 2688. E-mail: khraisat@lycos.com

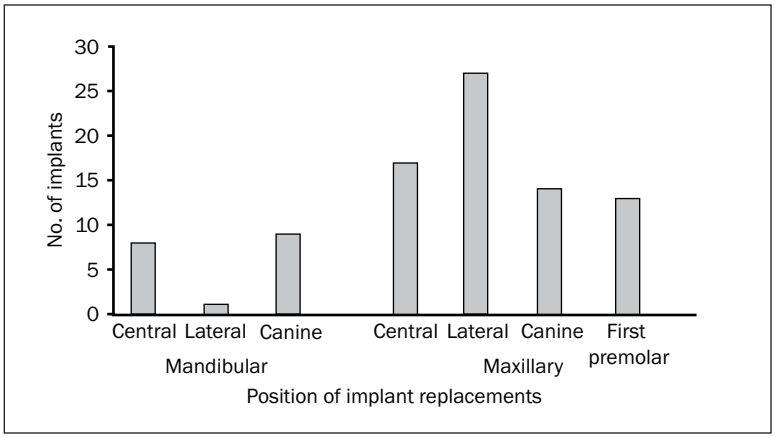

Fig 1 Distribution of implants by position in the mandible and maxilla.

MATERIALS AND METHODS

A retrospective study was conducted of all patients treated with implant-retained partial prostheses in a variety of dental offices in Jordan from April 2000 until March 2007. All prostheses were in function for a minimum of 1 year.

After surgical placement of implants and a healing period of 3 to 4 months, the implants were loaded with cement-retained single- or multiple-tooth prostheses. Polycarboxylate cement (Spofa Dental, Prague, Czech Republic) was used for all restorations. Metal ceramic restorations were applied to all placed implants.

The selected patients for implant treatment at the involved clinics were limited to those with short edentulous spans (1 or 2 missing teeth). Patients had adequate interarch space for abutments, prosthetic components, and the prosthesis, and sufficient bone dimensions to allow implant placement. Included patients were medically fit and nonsmokers.

Clinical examination and radiographic assessment were performed prior to implant placement. Radiographs were obtained immediately after surgery, 3 to 6 months after implant placement, and yearly after the surgical placement.

The condition of the prosthesis, implant stability, and adjacent mucosa were evaluated at each follow-up appointment. Patient symptoms were also recorded in the assessment of implant prosthesis success. Soft tissue health assessment was achieved by examining the redness, swelling, and bleeding.[10]

In this study, the success rate was recorded according to the criteria suggested by Albrektsson et al,[11] as follows: to be considered successful, the unattached implant was required to be immobile when tested clinically, with no evidence of radiographic peri-implant radiolucency; vertical bone loss was required to be less than 0.2 mm annually after the first year of loading; and the absence of persistent and/or irreversible signs and symptoms such as pain, infection, neuropathies, paresthesia, and/or violation of the mandibular canal was required.

Patient satisfaction (completely satisfied, moderately satisfied, or unsatisfied) was assessed by questioning patients briefly on recall or follow-up visits 3 to 6 months postplacement and annually thereafter.

The Fisher exact test was performed to test the presence of any statistically significant difference in success concerning gender or arch (mandible or maxilla; $P < .05$).

RESULTS

Forty-nine patients, 26 women and 23 men, underwent implant placement in the anterior region of the mandible or maxilla (including first premolars) at multiple clinical practices in Jordan. The age of the patients ranged from 17 to 85 years. A total of 87 solid-screw implants (Straumann, Basel, Switzerland) were placed and restored (38 in male and 49 in female patients). Eighteen implants were placed in mandible, and 69 in the maxilla (Fig 1). Among the placed implants, 65 implants were of the regular neck type (4.1 mm), while 22 were narrow-neck implants (3.3 mm). All placed implants had a length of 10 or 12 mm.

Upon clinical examination, 2 maxillary implants of 1 male patient exhibited significant horizontal bone loss of 3 mm. The 2 single implants were 10-mm-long regular-neck implants and had been placed to restore 2 maxillary canines. Angulated abutments of 15 degrees were used for both canine replacements. Another regular-neck implant placed in maxillary first premolar area of a different male patient showed similar signs. Those 3 implants were still functioning until the time of preparing this report. They were included in calculating the survival rate but were not consid-

ered successful.[11] The cumulative implant survival rate was 100%, while the success rate was 95.78% (Table 1). No signs of failure were noticed in any female patients or for any mandibular implants.

Regarding restorative complications, 3 maxillary crowns were each decemented once. In each case, the crown was recemented, and no further cement complication was reported during the study period.

Radiographically, in general, all implants were free of radiographic signs of morbidity. A very minimal marginal bone loss was noticed before loading in some cases, but it was less than 0.2 mm after the first year of service. Soft tissue complications, gingival inflammation and mucosal irritation, were observed and controlled during the period of observation.

Among patients, 97.70% were completely satisfied with their prosthesis, as there were no complications regarding the implant itself or the prosthesis. The aforementioned patient with horizontal bone loss in 2 implants was moderately satisfied. Concerning implant prostheses, 100% satisfaction was revealed.

Table 1 Cumulative Success Rate of Implants

Years of service	No. of implants in interval	No. of failures in interval	Success rate within interval (%)	Cumulative success rate (%)
0–1	87	0	100	100.00
1–2	79	2	97.47	97.53
2–3	59	1	98.31	95.78
3–4	41	0	100	95.78
4–5	27	0	100	95.78
5–6	18	0	100	95.78
6+	11	0	100	95.78

DISCUSSION

The results of this study demonstrated a favorable survival and success rate and patient satisfaction when the Straumann implants were used to replace missing teeth.[12–14] The cumulative success rate of 87 implants loaded from 1 to more than 6 years was 95.78%.

The 2 canine implants that showed significant horizontal bone loss in 1 patient were both restored with angulated abutments. Moreover, the patient was proved to be diabetic during the follow-up period; his disease was then controlled. It was reported that the success of implants in diabetic patients may be slightly diminished, as bone density and mineralization are adversely affected by diabetes.[15] In the present study, the bone resorption observed in the diabetic patient may have been related to the diabetic condition. In addition, the use of angulated abutments may have aggravated the loading of the implant assembly, as greater bending moments are produced. This in turn would increase bone stress, which might then result in resorption around the implant neck.[16] Among other factors that can enhance bone resorption is bone quality. Previous studies identified higher failure rates when implants were placed in the maxilla or in type-4 bone.[17–21] The surgeon who performed implantation of the aforementioned canine implants observed low bone quality for the corresponding patient.

A recent retrospective study of 441 Straumann implants in 114 patients showed no relationship between implant failure and patient gender.[22] In the present study, no significant difference in success regarding gender was noticed, although implant failure occurred exclusively in male patients. The relatively small number of patients included in this study might make it difficult to have reasonably compared men and women.

Concerning restorative complications, the results of this report showed that 3 maxillary crowns were each decemented once during the follow-up period. After examination, a premature contact was detected on the lingual surface of those crowns and was removed. No further decementation of the recemented crown or other restorations was reported. The minimal restorative complications of the cement-retained restorations obtained in this study (3.45%) were comparable to those found in another recent study of Straumann implants.[4] In that study, only 1.20% of 600 cemented-implant restorations had restorative problems.

Soft tissue complications such as gingival inflammation or mucosal irritation were observed in the present study and in other studies.[20,21] These complications were easily resolved with oral hygiene instruction and practice and without any compromise in osseointegration.

Patient satisfaction with prostheses in the present study (100%) was higher than that of another study (97.40%) where Straumann implants for both screw- and cement-retained restorations were used.[4] In the other report, the cumulative success rate was higher than that of the present study (99.10%), but the patients had a relatively high rate of restorative complications with the screw-retained restorations (19.70%). This might be the reason behind the small difference in patient satisfaction between the 2 reports.

Finally, the results of the present study indicate satisfactory outcome and capable performance for cement-retained implant restorations. However, extensive long-term studies with a greater number of implants may be needed to determine which specific criteria comprise optimal functional and esthetic results with minimum risk of morbidity.

CONCLUSIONS

Within the limit of this retrospective study, it can be concluded that cement-retention with the Straumann implant system is an adequate selection for anterior single- and multiple-tooth replacement among the Jordanian population. No significant differences in success regarding gender or arch of placement were noted. However, implant failures occurred in the maxillae of male patients. Restorative complications were minimal with the use of cement-retained prostheses.

REFERENCES

1. Adell R, Eriksson B, Lekholm U, Brånemark P-I, Jemt T. Long-term follow-up of osseointegrated implants in the treatment of totally edentulous jaws. Int J Oral Maxillofac Implants 1990; 5:347–359.
2. Cochran DL. The scientific basis for and clinical experiences with Straumann implants including the ITI Dental Implant System: A consensus report. Clin Oral Implants Res 2000; 11(suppl):33–58.
3. Bahat O. Brånemark system implants in the posterior maxilla: Clinical study of 660 implants followed for 5 to 12 years. Int J Oral Maxillofac Implants 2000;15:646–653.
4. Levine RA, Clem D, Beagle J, et al. Multicenter retrospective analysis of the solid-screw ITI implant for posterior single-tooth replacements. Int J Oral Maxillofac Implants 2002;17: 550–556.
5. Fugazzotto PA, Vlassis J, Butler B. ITI implant use in private practice: Clinical results with 5,526 implants followed up to 72+ months in function. Int J Oral Maxillofac Implants 2004; 19:408–412.
6. Richter EJ. Basic biomechanics of dental implants in prosthetic dentistry. J Prosthet Dent 1989;61:602–609.
7. Apse P, Ellen RP, Overall CM, Zarb GA. Microbiota and crevicular fluid collagenase activity in the osseointegration dental implant sulcus: A comparison of sites in edentulous and partially edentulous patients. J Periodontol Res 1989;24:96–105.
8. Mecall RA, Rosenfeld AL. Influence of residual ridge resorption patterns on implant fixture placement and tooth position. Int J Periodontics Restorative Dent 1991;11:8–23.
9. Zarb GA, Schmitt A. The longitudinal clinical effectiveness of osseointegrated dental implants in posterior partially edentulous patients. Int J Prosthodont 1993;6:189–196.
10. Ramfjord SP. Indices for prevalence and incidence of periodontal disease. J Periodontol 1959;30:51–59.
11. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. Int J Oral Maxillofac Implants 1986;1:11–25.
12. Romeo E, Chiapasco M, Ghisolfi M, Vogel G. Long-term clinical effectiveness of oral implants in the treatment of partial edentulism. Clin Oral Implants Res 2002;13:133–143.
13. Henry PJ, Laney WR, Jemt T, Harris D, et al. Osseointegrated implants for single tooth replacement: A prospective 5-year multicenter study. Int J Oral Maxillofac Implants 1996;11: 450–455.
14. Palmer RM, Smith BJ, Palmer PJ, Floyd PD. A prospective study of Astra single tooth implants. Clin Oral Implants Res 1997;8: 173–179.
15. Fiorellini JP, Chen OK, Nevins M, Nevins ML. A retrospective study of dental implants in diabetic patients. Int J Periodontics Restorative Dent 2000;20:366–373.
16. Khraisat A, Abu-Hammad O, Al-Kayed AM, Dar-Odeh N. Stability of the implant/abutment joint in a single-tooth external-hexagon implant system: Clinical and mechanical review. Clin Implant Dent Relat Res 2004;6:222–229.
17. van Steenberghe D. A retrospective multicenter evaluation of the survival rate of osseointegrated fixtures supporting fixed partial prosthesis in the treatment of partial edentulism. J Prosthet Dent 1989;61:217–223.
18. Kopp CD. Brånemark osseointegration. Prognosis and treatment rationale. Dent Clin North Am 1989;33:701–731.
19. Jaffin RA, Berman CL. The excessive loss of Brånemark fixtures in type IV bone: A 5-year analysis. J Periodontol 1991;62:2–4.
20. Jemt T, Pettersson P. A 3-year follow-up study on single implant treatment. J Dent 1993;21:203–208.
21. Laney WR, Jemt T, Harris D, et al. Osseointegrated implants for single-tooth replacement: Progress report from a multicenter prospective study after 3 years. Int J Oral Maxillofac Implants 1994;9:49–54.
22. Penarrocha M, Guarinos J, Sanchis JM, Balaguer J. A retrospective study (1994–1999) of 441 ITI implants in 114 patients followed-up during an average of 2.3 years. Med Oral 2002;7: 144–155.