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Survival Rates of Transitional Implants Supporting Screw Retained Restorations

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Introduction: Transitional implants (TIs) have been shown to be a viable method of providing fixed provisional restorations for the implant patient who wishes to avoid any removable temporary prostheses during implant healing. Most of the commercially available transitional implants were designed to support cementable restorations. The main advantage of the new screw retained transitional implant (SRTI) system is the avoidance of macro-movement that may occur during the removal of the provisional restorations during the implant healing phase. **Materials and Methods:** Between March 2001 and April 2004 seventeen patients (8 male, 9 female) received a total of 60 SRTIs. Forty-four of the SRTIs were placed in the mandible of which 38 SRTIs in 9 patients were used to support provisional prostheses, while 6 of the SRTIs in 2 patients were planned to support a longer term provisional restoration. Of the 16 SRTIs placed in the maxilla, 13 SRTIs in 5 patients were used to support provisional prostheses, and 3 SRTIs in 2 patients were planned to support a longer term provisional restoration. In the mandible 4 of 11 patients were fully edentulous, the other 7 patients were partially edentulous. In the maxilla only 1 patient was fully edentulous and 5 patients were partially edentulous. Twenty-four SRTIs in 5 patients supported full arch provisional restorations and 36 SRTIs in 12 patients supported provisional restorations where there was a partial dentition present. **Results:** At the time of evaluation for this prospective report the SRTIs had been functioning for an average time of 8.1 months (range 1- 35 months). In the mandible 4 SRTIs in 3 patients became mobile. Therefore the survival rate of SRTIs in the mandible was 90.09 % (40/44). In the maxilla 6 SRTIs in 3 patients became mobile. The survival rate of the SRTIs in the maxilla was 62.50 % (10/16). With the exception of 2 prostheses, all of the prosthetic complications were corrected with no loss of function. The overall survival rate of the fixed provisional restorations supported by the SRTI system was 88.24 %. The overall survival rate of all the SRTIs placed was 83.33 %. **Conclusion:** The current investigation has demonstrated the successful use of a screw retained transitional implant system for the support of fixed provisional prostheses in the mandibular arch. Further data is needed to determine the predictability and survival rates of SRTIs placed in the maxilla in fully and partially edentulous areas.

According to the original documented surgical and restorative protocols for submerged and non-submerged implants, healing in the absence of functional loading for a period of 4 to 6 months was deemed necessary to achieve osseointegration (1-4). Where inadequate bone levels existed surgical ridge augmentation techniques have been used to enable placement of implants (5, 6). In order to avoid premature undesired loading of implants and augmented areas, patients were required to refrain from wearing any removable prostheses for at least 2-6 weeks after the surgery. Therefore whenever possible tooth-supported fixed or removable provisional restorations were utilized (7). However, this type of restoration was not feasible in every patient due to lack of supporting teeth. Recently the use of immediate functional loading of implants has been reported for multiple or single implants (8-14). This technique can reduce the number of surgical procedures and shorten the treatment time. However, the use of multiple implants for immediately loaded fixed implant supported restorations requires cross-arch stabilization with at least 4 or 5 implants longer than 10 mm, and is mainly indicated in fully edentulous patients (12). Immediate loading of single implants has been demonstrated (15, 16). However, to date long term documentation is lacking on immediate single or multiple functionally loaded implants.

Several years ago the concept of the immediately loaded transitional implant (TI) was introduced (17-19). The TI supported provisional appliance provided an implant patient with a fixed temporary prosthesis prior to and during the postoperative healing period (20, 21). The main advantage of fixed provisionals supported by TIs was to avoid transmucosal loading of permanent implants and bone-augmented areas. Moreover these provisional restorations often functioned as a guide for the desired occlusion and esthetics in planning the final implant supported restoration.

Currently there are several different transitional implant systems available. However, to date all documented cases presented in the literature, utilized cemented provisional prostheses on the transitional implants. The disadvantages of cemented prostheses include the following difficulties; retrievability, removal of subgingival cement remnants, and the challenge of fabricating a provisional with minimal occlusal clearance. Moreover, the macro-movement caused by the removal of cement retained provisional restorations occasionally caused loosening or fracturing of the TIs (22). In an attempt to avoid these complications a new screw retained transitional implant (SRTI) system has been introduced (ANEW, Dentatus, New York, NY)(Fig 1).

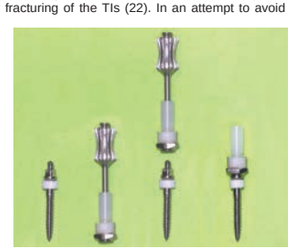

Fig 1 Components of SRTIs

Advantages of these screw retained TIs include the ability to avoid macro movement, and the ease of insertion and removal of the provisional appliances. Additional advantages include the ability to fabricate a provisional in cases with minimal occlusal clearance. Moreover because the screw retained provisional can be easily removed, either non-absorbable or absorbable sutures may be used according to operator preferences in implant or augmentation surgeries.

This study was undertaken to document the survival rates of transitional implants supporting screw retained restorations.

MATERIALS AND METHODS

Between March 2001 and April 2004 seventeen patients (8 male, 9 female) received a total of 60 SRTIs. Forty-four of the SRTIs were placed in the mandible of which 38 SRTIs in 9 patients were used to support provisional prostheses, while 6 of the SRTIs in 2 patients were planned to support a longer term provisional restoration. Of the 16 SRTIs placed in the maxilla, 13 SRTIs in 5 patients were used to support provisional prostheses, and 3 SRTIs in 2 patients were planned to support a longer term provisional restoration. In the mandible 4 of 11 patients were fully edentulous, the other 7 patients were partially edentulous. In the maxilla only 1 patient was fully edentulous and 5 patients were partially edentulous. Twenty-four SRTIs in 5 patients supported full arch provisional restorations and 36 SRTIs in 12 patients supported provisional restorations where there was a partial dentition present.

In the maxilla 6 SRTIs in 3 patients became mobile and were removed. The survival rate of the SRTIs in the maxilla was 62.5 % (10/16). With the exception of 2 prostheses, all of the prosthetic complications were corrected with no loss of function. Both patients with the failures of all the SRTIs placed received a removable partial denture.

The survival rate of the SRTIs in the full arch cases was 87.5 % (21/24). The survival rate of the SRTIs in the partial restoration cases was 80.56 % (29/36). The overall survival rate of all the SRTIs placed was 83.33 % (50/60).

The overall survival rate of the provisional restorations supported by the SRTI system was 88.24 % (15/17).

Fig 2 Edentulous upper & lower anterior area

Fig 3 Thin knife edge ridge with concavity

Fig 6 Hopeless upper anterior teeth due to endo

Fig 7 Three weeks post-extraction

Fig 4 Two SRTIs were placed

Fig 5 TI supported fixed provisional restoration

Fig 8 Two SRTIs & 2 permanent implants were

Fig 9 TI supported fixed provisional restoration

Sequence of the Procedures to Fabricate a SRTI Supported Prosthesis (Fig 2-9)

Presurgical procedure:

The patients were instructed to start rinsing twice a day one day prior to surgery with 0.12 % Chlorhexidine gluconate (Peridex). The patients were premedicated with 2 g of Amoxicillin 1 hour prior to the surgery, except for 1 patient with an allergy to penicillin, who received 600 mg Clindamycin 1 hour prior to surgery.

Surgical procedure:

1. Anesthesia: the intraoral surgical area was anesthetized utilizing lidocaine 2 % (with epinephrine 1:100,000) with block and infiltration anesthesia
2. A crestal incision was made
3. A full thickness periosteal flap was reflected
4. Osteotomies were made with a laser-marked drill to the full depth of the desired TI at approximately 800-1000 RPM with a copious supply of sterile water or saline solution
5. The SRTIs were inserted
6. Protective spacers were placed at the gingival margins to block out undercuts
7. Tension free suturing was performed

Prosthetic procedures

8. The copings were seated on the implant and tightened with a cylindrical plastic screw
9. The height of the plastic screws were adjusted to allow occlusal clearance
10. Titanium bars were inserted between implants to reinforce the provisional restoration (optional)
11. Brass plugs were inserted into the plastic screws to locate and protect the plastic screw while drilling occlusal access holes
12. Tooth colored self-curing resin was placed into the preformed omnivac shell and placed over the coping and screw assembly
13. Occlusal screw holes were opened according to the position of the brass plugs
14. Occlusal adjustment and finalization of provisional restoration
15. Delivery of provisional restoration

RESULTS

At the time of evaluation for this prospective report the 60 SRTIs had been functioning for an average time of 8.1 months (range 1- 35 months)(Table 1).

In the mandible 4 out of 44 SRTIs failed. Two SRTIs in 2 patients became mobile. Both SRTIs were removed although the provisional restorations maintained their function. Two SRTIs in 1 patient fractured after 6.5 months and were removed. The remaining 2 SRTIs maintained their function, and 2 additional SRTIs were placed. Therefore the survival rate of SRTIs in the mandible was 90.09 % (40/44).

DISCUSSION

The primary function of the TI system is to absorb masticatory stress during the healing phase with the use of a fixed provisional prosthesis. The goal is to ensure a stress-free maturation of the bone surrounding the submerged implants, and an unloaded healing of bone-grafted sites. The TI supported provisional prostheses allow the patient to wear a stable prosthesis that will mimic the final restoration (20, 23). El Attar et al. (24) reported that patients experienced greater satisfaction because of the immediate restoration of function and esthetics. The placement of TIs improved the acceptance by patients of their transitional states of edentulism. Additional uses of TIs include support of a surgical guide (25) and orthodontic anchorage (26). The small diameter of the TIs results in minimal bone removal, whereas the length allows sufficient anchorage for occlusal function.

Transitional implants additionally can provide longer-term support of fixed provisional prostheses in areas of limited bone that would preclude the use of standard diameter implants (27).

The literature regarding transitional implants consists mainly of case reports (20, 21, 23, 28-31). A histological study in dogs was done by Zubery et al. (32), which reported that TI failure maybe be associated with low quality of the bone at the implant site, relative excessive loads and insertion of the TIs via the mucosa. Froum et al. (33) showed that the average percentage of bone-to-implant contact of TIs was 52.9 %, which is similar to that of the conventional machined surfaced implants (34).

Transitional implants are generally made of commercially pure titanium or titanium alloy and are designed as one-piece implants composed of root and crown replacement segments. These TIs have a self-threading tapered screw design with diameters that range from 1.8 to 2.8 mm and implant screw length between 7 and 14 mm. Quirynen et al. showed a clear relationship between supragingival plaque and surface roughness (35). This group concluded that the reduced ability to clean a rough surface justifies the use of smooth surfaces for all intraoral supragingival hard surfaces. Wennstrom and Lindhe showed that a free gingival unit, which is supported by loosely, attached alveolar mucosa is not more susceptible to inflammation than a free gingival unit which is supported by a wide zone of attached gingival when placing machined surface implants (36). Following these conclusions various manufacturers fabricated machine surfaced implant designs.

Disadvantages of the TI technique include additional chair time required, increased laboratory expenses and a requirement for sufficient inter-implant bone. In addition, TI failure and fracture may result in localized bone loss. Proper placement and design of the implant supported TI restoration is essential in avoiding the later complications. The SRTI that was used in the current study enables retrievability that has the potential to decrease the incidence of fracture complications.

Gotfredsen and Karlsson (37) showed a survival rate of 95.1 % for the regular machined implants that supported fixed partial prostheses in the mandible premolar area. This is somewhat greater than the survival rate of 90.09 % of the SRTIs in the mandible reported in the present study. In general, implants placed in the mandible show a higher success rate than implants placed in the maxilla (38). Glauser et al. stated that the immediate loading concept is a realistic treatment except for the posterior part of the maxilla (39). This appears to hold true for the SRTIs used in this study, which demonstrated a survival rate of 90.09 % in the mandible and a 62.50 % survival rate in the maxilla. In the present study 2 of 17 fixed provisional restorations placed in 2 patients failed due to the failure of all the SRTIs placed. Both patients had the SRTIs placed in the maxilla and were used in a partially edentulous situation. The higher survival rate for mandibular full arch cases may be expected along with the lowest survival rate for maxillary partial dentition cases (40, 41). Further data is needed to determine the predictability of survival rates of SRTIs placed in fully or partially edentulous cases in both the mandible and maxilla. Furthermore, factors that effect success or failure (type of bone, number and arrangement of TIs, occlusal schemes) must also be identified.

CONCLUSION

The current investigation has demonstrated the successful use of the screw retained transitional implant system for the support of fixed provisional prostheses in the mandibular arch. The survival rate of SRTIs in this study was 83.33 %. One fixed SRTI supported provisional restoration in this study maintained function up to 35 months. This may imply longer-term effective use of SRTIs for the implant patient in the mandible. Further data is needed to determine the predictability and survival rates of SRTIs placed in the maxilla in fully and partially edentulous areas.

Patient	Gender	Age	Time (months)	Placed SRTIs	Failed SRTIs	Longer Term Use	Full or Partial Case	Maxilla / Mandible	Opp'g Dent	Final Rest'n
1	M	47	10	4	0	No	F	Mn	CD	Hybrid
2	M	67	7	5	1	No	F	Mn	RPD	FPD
3	M	65	8	4	2	No	P	Mn	FPD	FPD
4	F	86	35	5	0	Yes	P	Mn	FPD	FPD
5	M	67	2	5	1	No	F	Mn	CD	FPD
6	F	55	3	5	0	No	P	Mn	CD	OD
7	M	66	9	4	0	No	P	Mn	FPD	Hybrid
8	M	45	3	5	0	No	P	Mn	FPD	FPD
9	F	24	3	1	0	Yes	P	Mn	Natural Dent	FPD
10	F	45	2	2	0	No	P	Mn	RPD	FPD
11	F	70	1	4	0	No	F	Mn	CD	Hybrid
Average		57.9	7.5							
Total Mandible				44	4	Mandible Survival Rate			90.09%	
12	F	66	12	6	1	No	F	Mx	Natural Dent	Hybrid
13	M	63	3	3	3	No	P	Mx	Natural Dent	FPD
14	F	34	25	1	0	Yes	P	Mx	Natural Dent	FPD
15	F	55	4	2	0	No	P	Mx	Natural Dent	FPD
16	M	18	3	2	0	Yes	P	Mx	Natural Dent	FPD
17	F	35	2	2	2	No	P	Mx	RPD	FPD
Average		46.8	8.2							
Total Maxilla				16	6	Maxilla Survival Rate			62.50%	
Overall				60	10	Overall Survival Rate			83.33%	

REFERENCES

1. Adell R, Lekholm U, Rockler B, et al. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1981, 10(6):387 416
2. Branemark PI. Osseointegration and its experimental background. J Prosthet Dent 1983, 50(3):399-410
3. Buser DA, Schroeder A, Sutter F, et al. The new concept of ITI hollow-cylinder and hollow-screw implants: part 2. Clinical aspects, indications, and early clinical results. Int J Oral Maxillofac Implants 1988, 3(3):173-181
4. Deporter DA, Watson PA, Pilliar RM, et al. A prospective clinical study in humans of an endosseous dental implant partially covered with a powder-sintered porous coating: 3 to 4-year results. Int J Oral Maxillofac Implants 1996, 11(11):87 95
5. Jovanovic SA, Spiekermann H, Richter EJ. Bone regeneration on implants with dehisced defect sites. A clinical study. J Oral Maxillofac Implants 1992, 7:233-245
6. Nevins M, Mellonig JT. The advantages of localized ridge augmentation prioto implant placement : A staged event. Int J Periodont Rest Dent 1994, 14(2):96-111
7. Balshi TJ. Converting patients with periodontally hopeless teeth to osseoint gration prostheses. Int J Perio Rest Dent 1988;8:8-33
8. Schnitman PA, Wohrle PS, Rubenstein JE. Immediate fixed interim prostheses supported by two-stage threaded implants: Methodology and results. J Oral Implantol 1990, 16(2):96-105
9. Linkow LI, Donath K, Lemons JE. Retrieval analysis of a blade implant after 231 months of clinical function. Implant Dent 1992, 1(1):37-43
10. Schnitman PA. Branemark implants loaded with fixed interim prostheses at fi ture placement: Nine-year follow-up. J Oral Implantol 1995, 21:235
11. Salama H, Rose LF, Salama M, Betts NJ. Immediate loading of bilaterally splinted titanium root-form implants in fixed prosthodontics. A technique reexa ined: Two case reports. Int J Periodont Rest Dent 1995, 15(4):344-361
12. Tarnow DP, Emtiaz S, Classi A. Immediate loading of threaded implants at stage 1 surgery in edentulous arches: Ten consecutive case reports with 1 to 5 year data. Int J Oral Maxillofac Implants 1997, 12(3):319-324
13. Schnitman PA, Wohrle PS, Rubenstein JE, et al. Ten-year results for Branemark implants immediately loaded with fixed prostheses of implant plac ment. Int J Oral Maxillofac Impl 1997, 12(4):495-503
14. Wohrle PS. Single-tooth replacement in the aesthetic zone with immediate provisionalization : fourteen consecutive case reports. Pract Periodontics Aesthet Dent 1998, 10(9) :1107-1114 ;quiz 1116
15. Lorenzoni M, Pertl C, Zhang K, Wimmer G, Wegscheider WA. Immediate loading of single-tooth implants in the anterior maxilla. Preliminary results after one year. Clin Oral Implants Res. 2003 Apr;14(2):180-187
16. Chaushu G, Chaushu S, Tzohar A, Dayan D. Immediate loading of single tooth implants: immediate versus non-immediate implantation. A clinical report. Int J Oral Maxillofac Implants. 2001 Mar-Apr;16(2):267-272
17. Serdav Vl. Mini-implant strategy offers a broad range of uses. Dent Today 1995 ;14
18. Blatz MB, Hurzeler MB, Hildebrand D. Implant systems and their components. Implantol 1996, 4:357-360
19. Ravasini G, Ugolini G, Dalla TS, Ravasini F. Protocollo operativo per l'utizzo di impianti provvisori immediati (Mini Transitional Implants-MTI) Dialog 1996, 1:43-47
20. Froum SJ, Emtiaz S, Bloom M, Scolnick J, Tarnow DP. The use of transitio al implants for immediate fixed temporary prostheses in cases of implant restor tions. Prac Periodontics Aesthet Dent 1998, 10:737-746
21. Petrungaro P. Fixed temporization and bone augmented ridge stabilization with transitional implants. Prac Periodontics Aesthet Dent 1997, 9:1071-1078
22. Michalakis KX, Hirayama H, Garefis PD. Cement-retained versus screw retained implant restorations: A critical review. Int J Oral Maxillofac Implants 2003, 18:719-728
23. Bichacho N, Landsberg CJ, Rohrer M, Davidovich Y. Immediate fixed trans tional restoration in implant therapy. Pract Periodontics Aesthet Dent 1999, 11(1):45-51
24. El Attar MS, El Shazly E, Osman S et al. Study of the effect of using mini-tra sitional implants as temporary abutments in implant overdenture cases. Implant Dent 1999, 8:152-158
25. Simon H. Use of transitional implants to support a surgical guide: Enhancing the accuracy of implant placement. J Prosthet Dent 2002, 87(2):229-232
26. Gray JP, Smith R. Transitional implants for orthodontic anchorage. J of Clinical Orthodontics 2000, 34(11):659-666
27. English CE, Bohle GC. Diagnostic, procedural, and clinical issues with the Sendax Mini Dental Implant 2003, 24 (suppl 1):3-25
28. Nagata M, Nagaoka S, Mukunoki O. The efficacy of modular transitional implants placed simultaneously with implant fixtures. Compend Contin Educ Dent 1999, 20(1):39-42
29. Bohsali K, Simon H, Kan JY, Redd M. Modular transitional implants to su pport the interim maxillary overdenture. Compend Contin Educ Dent 1999, 20(10):975 8,980,982-983
30. Petrungaro PS. Reconstruction of severely resorbed atrophic maxillae and management with transitional implants. Implant Dent 2000, 9(3):271-277
31. Brown MS, Tarnow DP. Fixed provisionalization with transitional implants for partially edentulous patients: a case report. Pract Proced Aesthet Dent 2001, 13(2):123-127
32. Zubery Y, Bichacho N, Moses O, Tal H. Immediate loading of modular trans tional implants: A histologic and histomorphometric study in dogs. Int J Periodontics Rest Dent 1999, 19:343-353
33. Froum SJ, Young SC, Simon HH, Cho SC, Elian N, Tarnow DP. Histological evaluation of bone-implant-contact of transitional implants loaded for various time periods. 2004 (submitted for publication)
34. Lazzara RJ, Testori T, Trisi P et al. A human histologic analysis of osseotite and machined surfaces using implants with 2 opposing surfaces. Int J Periodontics Rest Dent 1999, 19:117-129
35. Quirynen M, van der Mei H.C., Bollen CL, Schotte A, Marechal M. DoornbuschGI, Naert I. Busscher HJ, van Steenberghe D. An in vivo study of the influence of the surface roughness of implant on microbiology of supra- and su gingival plaque. J Dent Res 1993, 72(9):1304-1309
36. Wennstrom J, Lindhe J. Plaque-induced gingival inflammation in the absence of attached gingiva in dogs. J Clin Periodontol 1983, 10:266-276
37. Gotfredsen K, Karlsson U. A prospective 5-year study of fixed partial prosth ses supported by implants with machined and TiO2-blasted surface. J Prosthodont 2001, 10(1):2-7
38. Cochran DL. A comparison of endosseous dental implant surfaces. J Periodontol 1999, 70(12):1523-1539
39. Glauser R, Ree A, Lundgren A, Gottlow J, Hammerle CH, Scharer P. Immediate occlusal loading of Branemark implants applied in various jawbone regins: a prospective, 1-year clinical study. Clin Implant Dent Relat Res 2001, 3(4):204-213
40. Jaffin RA, Berman CL. Excessive loss of· Branemark fixtures in type IV bone: a 5-year analysis. J Periodontol 1991, 62:2-4
41. Adell R, Eriksson B, Lekholm U, Branemark PI, Jemt T. Long-term follow-up study of osseointegrated implants in the treatment of totally edentulous jaws. Int J Maxillofac Implants 1990, 5(4):347-359