Original Article

Received: Apr. 2013
Accepted: July. 2013

Clinical Outcomes of Conventional and Immediate Placement of Dental Implants in a Group of Iranian War-wounded Patients

Jafarian,M.* Iezadi, M.**

*Associate Professor, Dept. of Periodontics, Dental Faculty, Shahid beheshti University of Medical Sciences, Tehran, Iran.

**Post-graduate student, Dental Research Center, Dental Faculty, Isfahan University of Medical Sciences, Isfahan, Iran.

ABSTRACT

Statement of the Problem: In recent decades, immediate implant placement has been proposed to eliminate undesirable consequences of conventional methods of delayed placement. In addition, because of the nature of this treatment method, a higher risk of complications such as infection and also higher failures rates may be expected.

Purpose: The aim of this study was to compare clinical outcomes of conventional and immediate placement of dental implants in a group of Iranian war-wounded subjects.

Materials and Methods: In a cross-sectional study, a questionnaire was filled for war-wounded patients referred for dental implants to Ghazi Tabatabaei Clinic in Tehran from March 2000 to March 2007. Finally univariate and then multivariate analyses of clinical outcomes of implantation were carried out.

Results: A total of 271 implants, placed in 42 patients, were assessed. In the univariate analysis only associated interventions had a significant effect (P=0.018) while use of grafts (P=0.071), method of implantation (P=0.054) and length of implant (P=0.057) had a tendency toward significant relation with clinical outcomes of implantation. Logistic regression model showed that use of graft and longer implants were independently associated with clinical failure of implantation.

Conclusion: In this study with limited follow-up period 3% of implants failed clinically, with a tendency toward higher rates for immediately placed ones. Besides, use of grafts during associated interventions was associated with higher probability of clinical failure which could show that these interventions could even worsen the clinical outcome of implantation. The finding that longer implants had higher rates of failure might be attributed to short follow-up period.

Keywords: Absorbable Implants, Clinical outcome, Immediate placement, War-wounded.

INTRODUCTION

A standard method of treatment for extracted and missing teeth is replacing them by dental implants.(1) As mentioned in the original and conventional protocols, dentists had to wait for several months after tooth extraction before placement of the implants. In this way, this interval could cause a good healing of the alveolar bone.(2) Thus the implant would be placed in partially or completely healed bone.(3) In this conventional protocol, which is now called delayed placement of implant, a long treatment period is an obvious drawback.(1) Besides, patients mostly prefer to leave the dentist's clinic with an implant at the site of extracted teeth.(1)

Corresponding Author: M. Iezadi Address: Dept. of Periodontics, Dental school, Isfahan University of Medical Sciences, Isfahan, Iran. Tel:09131012493 E.mail:Mozhgan.izadi.1165@yahoo.com

In recent decades, in order to remove the undesirable consequences of conventional methods, this protocol has been challenged by reducing the interval between tooth extraction and placement of the implant[1] so that some clinicians have used "immediate implant placement" technique. In this method dental implants are placed in fresh sockets just after tooth extraction in the same clinical session. This allows clinicians to reduce the number of surgical procedures, resulting in shorter treatment durations.[4] Another method named "early implant placement" used in parallel in which placement of implants is carried out after weeks up to about two months after teeth extraction. In conventional and early placement, implants are placed while bone healing and soft tissue healing happened, respectively. In contrast, neither the bone nor the soft tissue has healed in immediate placement.[3]

Although bone healing has not happened in immediate placement, it is believed that it not a weak point of immediate placement as it is proposed that this method would lead to a better maintenance of hard and soft tissues and minimize the loss of these tissues at the extraction site.[1,5-9] However, controversies exist on this issue so that recent animal and clinical studies indicate that morphologic changes of the alveolar ridge cannot be prevented by the immediate placement protocol. It was shown that the buccal and lingual socket walls underwent marked resorption following implant placement and that the height of the buccal hard tissue wall decreased.[10–13] This problem could cause further technical problems. In other words, based on these studies, immediate implant placement may also lead to the inability to predict future soft and hard tissue level and difficulty in achieving implant primary stability.[4]

On the other hand, compared with delayed implant placement, an assumptive advantage of immediate placement method is that it could result in better aesthetics and higher patient satisfaction compared with delayed implant placement through reducing treatment duration, decreasing surgical interventions and preserving soft and hard tissues and therefore, maintaining bone height.[1,3,7–9] However, this issue is a matter of controversy and data on the esthetic outcomes following immediate or early implant placement are still inconclusive. While immediate placement of single-tooth implants often shows predictable and superior

esthetic results, the immediate placement of multiple adjacent implants is far less predictable.[14] Thus contradictory conclusions have been reached in a direct comparison of the esthetic outcomes following the early and delayed placement techniques for multiple adjacent implants. Thus, other factors than the timing of implant placement such as position and angulation of the implant, gingival biotype and implant design may be more important for the achievement of optimal esthetic results.[1]

In addition, because of the nature of this treatment method, a higher risk of complications such as infection and also higher failure rates may be expected.[1,3] More studies with hard evidence, preferably randomized controlled trials (RCTs), over a long time frame are required to compare the two methods.[15] Furthermore, it is necessary to assess clinical outcomes of various methods of immediate implant placement. For example it is necesary to compare use of augmentation when dehiscence defects are present with situations in which no additional intervention is made.[1]Furthermore, **s**tudies are needed to understand the possibility of immediate implant loading in major subgroups of patients.[16] In this regard war-wounded patients are of great importance. They frequently need dental implants as a result of high prevalence of maxillofacial injuries in this group of people. Therefore, due to presence of a large number of war-wounded patients in Iran, the present study was undertaken to compare clinical outcomes of conventional and immediate placement of dental implants in a group of Iranian war-wounded patients.

MATERIALS AND METHODS

In a cross-sectional study, war-wounded patients who were referred for dental implants to Ghazi Tabatabaei Clinic in Tehran from March 2000 to March 2007 were evaluated. Regarding these conditions 42 patients were enrolled in the study. A questionnaire was filled based on Declaration of Helsinki.

Variables of the questionnaire included age, gender, percentage of self-sacrifice, type of injury, osseous density (defined as a ranking of D1 or D2-3 or D4), primary stability, implantation method (immediate placement or conventional method), implant length, implant width, implant brand, interventions associated with implantation, use of graft during implantation, type of graft used, the interval between primary and second

surgery, method of second surgery and the interval between second surgery, clinical outcome of implantation (success or failure) and date of clinical failure of implant.

Data were analyzed with SPSS 18; univariate analysis of clinical outcome of implantation was carried out by using chi-squared and Fisher's exact tests for qualitative and Student's t-test or Kolmogorov-Smirnov test for quantitative tests. Subsequently, multivariate analysis of clinical outcome of implantation was carried out using logistic regression analysis (backward model) (Entry<0.05 and Removal>0.05).

RESULTS

A total of 271 implants, placed in 42 patients, were assessed. Seventeen (6.3%) and 254 (93.7%) implants were placed in females and males, respectively. Age of patients was determined for 245 implants for which the mean was 52.19 years with standard deviation of 6.05 years.

Descriptive and univariate analytical statistics of all the variables are summarized in Table 1. Mean percentage of self-sacrifice was 46.13% and type of injury was only maxillofacial injury for 132 implants (56.4), only spinal for 7 (3%), maxillofacial and spinal for 4 (1.7%), neuropsychological and maxillofacial for 48 (20.5%), chemical and maxillofacial for 27 (11.5%), chemical and neuropsychological and maxillofacial for 15 (6.4%) and of all types of spinal, chemical, neuropsychological and maxillofacial for 1 (0.4%). Osseous density was mostly of D2-D3 type as primary instability was good in most cases.

Among the whole 271 implants placement was of immediate type in 81 ones only (29.9%) while 190 implants (70.1%) were placed following conventional protocols. Mean length and width of whole implants were 11.84 and 3.93 millimeters, respectively. Brand of the implant was "3i" for 116 implants (42.8%), "Xive" for 78 (28.8%), "Biohorizon" for 39 (14.4%), "Frialit" for 23 (8.5%), "MKIIITiVQ" for 11 (4.1%) and "Noble Biocare" for 4 (1.5%).

In addition to the placement of 87 implants (35.8%) another intervention was made in the same clinical session. Among these 87 interventions, the associated intervention was augmentation for 23 implants (8.5%), bone expansion for 24 (8.9%), closed sinus lift for 17 (6.3%), autogenously bone graft for 12 (4.4%), membrane use

for 3 (1.1%), augmentation and membrane use for 7 ones (2.6%), augmentation and bone expansion for 5 (1.8%), augmentation and autogenously bone graft for one implant (0.4%), augmentation and bone expansion and membrane use for 3 (1.1%) and finally autogenously bone graft and vestibuloplasty and membrane use for 2 implants (0.7%). As a result of these interventions, graft was used with 66% of implants (25.3%). Among these 66 cases, graft was autogenous for 8 implants (12.1%) and synthetic for other ones. Among them type of graft was Algipore (Dentsply Friadent, Mannheim, Germany) for 31 ones (47%), Bioss (Osteohealth Co., Shirley, NY) for 22 (33.3%), Cera-sorb (Aap Implantate, Alemania) for one implant (1.5%), autogenous and Bioss for one implant (47%) and Algipore and Bioss for 3 implants (4.5%).

Among the 76 implants for which data about second surgery was available, it was not performed in two cases (2.6%). For the other 74 ones the mean period between primary and second surgery was 11.1 months (Table 1).

As a result, clinical success was present for 263 implants (97%) during the follow-up period. Clinical failure of implantation was present for only 8 implants (3%). Among these eight implants, mean interval between implant placement and fail was 5.86 months with a standard deviation of 4.48 months.

Univariate analysis of clinical outcome was carried out for all the variables except for osseous density. Osseous density of none of 8 failed implants was determined, making it impossible to assess the effect of osseous density on clinical outcome. For all the assessed qualitative variables Fisher's exact test was used. In addition, as only 8 implants failed, for all the quantitative variables Kolmogorov-Smirnov (K-S) test was used to determine whether distribution of the quantitative variable was normal in these failed cases. As for all the variables K-S test was not significant and distribution of the quantitative variable was normal in failed cases, Student's t-test was used for all the quantitative variables.

As it is shown in Table 1, only associated interventions had a significant effect on clinical outcomes of implantation (P=0.018) while use of graft (P=0.071), method of implantation (P=0.054) and length of implant (P=0.057) had a tendency toward significant relation with clinical outcomes of implantation.

Thus the four variables of associated interventions, use of graft, method of implantation and length of implant were entered in the logistic regression model (Code 1 was used in the application of qualitative variables and code 0 was used in non-use of them). By using backward LR method, it was shown that only use of graft and length of implant had an independent relation with clinical outcomes of implantation (Table 2) so that use of graft and longer implants were associated with clinical failure of implantation.

To define the cause of higher failure in immediate placement, relation of implantation method and the two independent indicators of clinical failure, use of graft and length of implant, was assessed. As it is shown in Table 3 there was a significant relation between method of implantation and implant length but not with graft use so that immediate implantation was associated with longer implants, which in itself was related to failure of implantation.

In addition, to measure the predetermined effective variable of primary stability, relation of primary stability and clinical outcome was assessed for immediately placed implants. Chi-squared test showed that poor primary stability was significantly associated with higher rates of clinical failure (P=0.008).

Table 1. Descriptive statistics and univariate analysis of measured variables

Variable		[mean±SD] or [percent(frequency)]	Univariate analysis of clinical outcome			
			[mean±SD] or [percent(frequency)] of the variable in each group		Pearson Chi-square or T-value	P
			G1: Clinical success	G2: Clinical fail		
Age (years)		46.13±6.05	46.08±6.05	47.71±6.37	-0.703	0.483
Gender	female	6.3 (17)	3.12 (8)	0 (0)	0.552	1.000
	male	93.7 (254)	96.88 (248)	8 (100)		
Percentage of self-sacrifice		46.13±6.05	41.54±15.33	40.0±16.69	0.280	0.780
Type of injury		-	-	-	8.643	0.341
Osseous density	D2-D3	93.5 (58)	93.5 (58)	-	-	-
	D4	6.5 (4)	6.5 (4)	-		
Primary stability	good	91.3 (137)	91.8 (134)	75 (3)	3.237	0.307
	intermediate	3.3 (5)	3.4 (5)	0 (0)		
	poor	5.3 (8)	4.8 (7)	25 (1)		
Implant method	immediate	29.9 (81)	28.9 (76)	67.5 (5)	4.183	0.054
	conventional	70.1 (190)	71.1 (187)	33.5 (3)		
Implant length (mm)		11.84±1.56	11.81±1.55	12.87±1.43	- 1.909	0.057
Implant width (mm)		3.93±0.52	3.94±0.52	3.66±0.33	1.483	0.139
Implant brand		-	-	-	6.169	0.276
Associated interventions		-	-	-	53.445	0.018
Graft	Used	25.3 (66)	24.4 (62)	57.1 (4)	3.863	0.071
	Not used	74.7 (195)	75.6 (192)	42.9 (3)		
Graft type		-	-	-	6.050	0.132
2nd surgery method	Crestal incision	90.8 (69)	90.6 (68)	100 (1)	0.103	1.000
	Stab incision	6.6 (5)	6.7 (5)	0 (0)		
	Not performed	2.6 (2)	2.7 (2)	0 (0)		
Interval between two surgeries (month)		11.10±11.2	11.11±11.28	10.80±12.63	0.060	0.952

Table 2. Logistic regression analysis of clinical outcome of implantation

	B	S.E.	Wald	df	Sig.	Exp (B)
Use of graft (yes=1)	1.724	.834	4.269	1	.039	5.605
Implant length	.713	.324	4.846	1	.028	2.040
Constant	-13.220	4.407	8.998	1	.003	.000

Table 3. Relation of clinical outcome of implantation with use of graft and length of implant

Variable		[mean±SD] or [percent(frequency)]	Univariate analysis of implantation method			
			[mean±SD] or [percent(frequency)] of the variable in each group		Pearson Chi-square or T-value	P
			G1: immediate	G2: conventional		
Graft	Used	25.3 (66)	31.57 (24)	22.7 (42)	3.863	0.158
	Not used	74.7 (195)	68.43 (52)	77.3 (143)		
Implant length (mm)		11.84±1.56	12.42±1.36	11.59±1.58	4.095	< 0.001
Primary stability	good	91.3 (137)	92.7 (38)	50 (1)		
	intermediate	3.3 (5)	4.9 (2)	0 (0)		
	poor	5.3 (8)	2.4 (1)	50 (1)		

DISCUSSION

Although some studies have described clinical success in up to 99% of implantations,[17] in general and based on previous studies approximately 5% of implants can be expected to be lost regardless of the protocol used.[1,18] In the present study with limited follow-up period 3% of implants failed clinically. Thus, the low rate of clinical failure of implants in this study could be partly due to the short follow-up period.

The rate of clinical failure for immediately placed implants has been different in different studies. For example in one study it was 1% for immediately placed molar implants.[17] It has been shown that immediate implant placement by novice operators using routine dental school procedures is a highly predictable procedure as indicated by the 100% success rate at 12 months. Most patients rated the restoration appearance as excellent.[19] In another study forty patients received a total of 43 implants placed in fresh extraction sites in the anterior maxilla. After 1 year, the overall survival rate was 95.3%.[20] Overall, in a systematic review it was shown that the implant loss ranged from zero to 40% for immediate implants.[21] The rate of clinical failure of immediately placed implants in our study was within this range and was 6.17%.

As the two methods of immediate and delayed placement were compared, in some previous studies there was no significant difference in clinical success rates of the two methods.[1,17,22]. However, based on the majority of previous studies, higher risk of failures seems to exist with immediate placement compared with a delayed, conventional approach.[1] For example, a systematic review and meta-analysis was carried out on studies that specifically compared immediate and conventional loading of single-implant crowns and the overall treatment effect was estimated. This systematic review and meta-analysis showed that better outcomes are currently achieved using conventional loading of single implants with crowns, as opposed to immediately loaded ones, which are at a higher risk of failure.[23] Thus it is advised that this treatment modality should be restricted to skilled well-trained teams.[1] Similarly, 1.57% of delayed implants failed, which showed a tendency toward significant difference when compared to immediately placed implants (P=0.054) so that it is expected to have higher probability of clinical failure for immediately placed ones.

Among the geometric properties of implants, implant length and width are of great importance. One study reported a 50% failure rate with immediate loading for implant lengths below 10 millimeters;[24] therefore, the majority of studies have suggested that implants should be more than 10 millimeters in length to ensure high success rates.[25–28] On the other hand, the presence and the size of the gap between

the implant surface and the bone walls of the sockets are both influenced by the configuration of the alveolus and by the design and width of the implant.[1] In this context, wide-diameter implants have been used in healed bone and in extraction sockets with success.[29–30] Overall, some authors even speculate that it is beneficial to use implants more than 14 millimeters in length and more than 4 millimeters in diameter for immediate loading.[31] However, in the present study, clinical success was not significantly related to implant width. More surprisingly, the significant relation of clinical outcome and implant length in the present study were inversely related compared to other studies, i.e. longer implants had higher probability of failure. In fact in the present study all the 8 failed implants were longer than 10 millimeters. In addition, analysis of data showed that the majority of failures of immediate placement might be due to longer implants used for immediate implant placement. This result might be attributed, in part, to short follow-up periods in the present study. In addition, it is most likely due to the disturbed data entry in the questionnaires used as there is no acceptable explanation for it.

Among the immediately placed implants in the present study, poor primary stability was associated with higher probability of clinical failure. In fact a prerequisite for the success of intraosseous implant treatment is achievement of osseointegration,[32] which in itself needs good primary implant stability.[33] Thus of all factors involved, primary stability seems to be the most important determining factor for immediate implant loading. In summary, when primary stability is achieved and a proper prosthetic treatment plan is followed, immediate functional implant loading is a feasible concept. However, if the primary fixture stability cannot be achieved or is questionable, it is strongly recommended to follow a conventional treatment protocol, including an adequate healing time before loading.[16]

Apart from primary implant stability a sufficient amount of bone with good quality is needed.[1] An implant placed in compact dense bone is more likely to ensure initial stability and, hence, better able to sustain such immediate forces. Therefore, host bone density plays an important role in determining the predictability of the success of immediate implant loading.[16] However, bone quality was not determined for any failed implant in the present study, which made it impossible to evaluate the effect of bone quality on clinical outcome of implantation.

Considering the associated interventions used to fill small gaps between implant surface and socket wall, no consensus exists on the need for bone augmentation in these situations.[1] Studies have demonstrated that infrabony defects fully or partly resolve without intervention of augmentation treatments.[1] In 46 patients treated with

immediate implants total bone formation occurred in the sockets without the use of membranes or autogenous bone grafting.[34] In a randomized study comparing immediate and delayed implant placement a high potential for spontaneous healing in three-wall infrabony defects was demonstrated for both protocols.[8] Similarly in the present study use of grafts during associated interventions was associated with higher probability of clinical failure.

CONCLUSION

In the present study with a limited follow-up period 3% of implants failed clinically, which showed a tendency toward higher rates for immediately placed ones. Besides, use of grafts during associated interventions was associated with higher probability of clinical failure, demonstrating that these interventions could even worsen the clinical outcome of implantation. The finding that longer implants had higher rates of failure could be related to the short follow-up period.

REFERENCES

1. Schropp L, Isidor F. Timing of implant placement relative to tooth extraction. J Oral Rehabil 2008 Jan; 35 Suppl 1:33–43.
2. Branemark PI. Introduction to osseointegration. In: Branemark P-I, Zarb G, Albrektsson T, eds. Tissue-integrated prostheses. Osseointegration in clinical dentistry. Chicago, Berlin: Quintessence Publishing Co., 1985:11–76.
3. Esposito MA, Koukoulopoulou A, Coulthard P, Worthington HV. Interventions for replacing missing teeth: dental implants in fresh extraction sockets (immediate, immediate-delayed and delayed implants). Cochrane Database Syst Rev 2006(4):CD005968.
4. Koh RU, Rudek I, Wang HL. Immediate implant placement: positives and negatives. Implant Dent 2010 Apr; 19(2):98–108.
5. Denissen HW, Kalk W. Preventive implantations. Int Dent J 1991; 41:17–24.
6. Wheeler SL, Vogel RE, Casellini R. Tissue preservation and maintenance of optimum esthetics: a clinical report. Int J Oral Maxillofac Implants 2000; 15:265–71.
7. Lindeboom JA, Tjiook Y, Kroon FH. Immediate placement of implants in periapical infected sites: a prospective randomized study in 50 patients. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101:705–710.
8. Schropp L, Kostopoulos L, Wenzel A. Bone healing following immediate versus delayed placement of titanium implants into extraction sockets: a prospective clinical study. Int J Oral Maxillofac Implants 2003; 18:189–199.
9. Schropp L, Isidor F, Kostopoulos L, Wenzel A. Patient experience of, and satisfaction with, delayed-immediate vs. delayed single-tooth implant placement. Clin Oral Implants Res 2004; 15:498–503. Schropp L, Isidor F, Kostopoulos L, Wenzel A. Patient experience of, and satisfaction with, delayed-immediate vs. delayed single-tooth implant placement. Clin Oral Implants Res. 2004; 15:498–503.
10. Araujo MG, Sukekava F, Wennstrom JL, Lindhe J. Tissue modeling following implant placement in fresh extraction

sockets. Clin Oral Implants Res 2006; 17:615–24.

11. Araujo MG, Sukekava F, Wennstro¨m J, Lindhe J. Ridge alterations following implant placement in fresh extraction sockets: an experimental study in the dog. J Clin Periodontol 2005; 32:645–52.

12. Botticelli D, Berglundh T, Lindhe J. Hard-tissue alterations following immediate implant placement in extraction sites. J Clin Periodontol 2004; 31:820–28.

13. Covani U, Cornelini R, Barone A. Bucco-lingual bone remodeling around implants placed into immediate extraction sockets: a case series. J Periodontol 2003; 74:268–73.

14. Hurzeler MB, Fickl S, Zuhr O, Wachtel H. Clinical failures and shortfalls of immediate implant procedures. Eur J Esthet Dent 2006 Aug;1(2):128–40.

15. Henry PJ, Liddelow GJ. Immediate loading of dental implants. Aust Dent J 2008 Jun;53 Suppl 1:S69–81.

16. Gapski R, Wang HL, Mascarenhas P, Lang NP. Critical review of immediate implant loading. Clin Oral Implants Res 2003 Oct; 14:515–27.

17. Atieh MA, Payne AG, Duncan WJ, de Silva RK, Cullinan MP. Immediate placement or immediate restoration/loading of single implants for molar tooth replacement: a systematic review and meta-analysis. Int J Oral Maxillofac Implants 2010 Mar-Apr; 25(2):401–15.

18. Chen ST, Buser D. Clinical and esthetic outcomes of implants placed in postextraction sites. Int J Oral Maxillofac Implants 2009; 24 Suppl: 186–217.

19. Vidal R, Greenwell H, Hill M, Papageorgakopoulos G, Scheetz JP. Success rate of immediate implants placed and restored by novice operators. Implant Dent 2010 Feb; 19:81–90.

20. Valentini P, Abensur D, Albertini JF, Rocchesani M. Immediate provisionalization of single extraction-site implants in the esthetic zone: a clinical evaluation. Int J Periodontics Restorative Dent 2010 Feb; 30:41–51.

21. Quirynen M, Van Assche N, Botticelli D, Berglundh T. How does the timing of implant placement to extraction affect outcome? Int J Oral Maxillofac Implants 2007; 22 Suppl: 203–23.

22. Chen ST, Wilson TG, Jr., Hammerle CH. Immediate or early placement of implants following tooth extraction: review of biologic basis, clinical procedures, and outcomes. Int J Oral Maxillofac Implants 2004; 19 Suppl: 12–25.

23. Atieh MA, Atieh AH, Payne AG, Duncan WJ. Immediate loading with single implant crowns: a systematic review and meta-analysis. Int J Prosthodont 2009 Jul-Aug; 22:378–87.

24. Schnitman, P.A., Wohrle, P.S., Rubenstein, J.E., DaSilva, J.D. & Wang, N.H. Tenyear results for Branemark implants immediately loaded with fixed prostheses at implant placement. International Journal of Oral and Maxillofacial Implants 1997; 12:495–503.

25. Buser, D.A., Schroeder, A., Sutter, F. & Lang, N.P. (1988) The new concept of ITI hollow-cylinder and hollow-screw implants: Part 2. Clinical aspects, indications, and early clinical results. International Journal of Oral and Maxillofacial Implants 3:173–181.

26. Lefkove MD, Beals, RP. Immediate loading of cylinder implants with

overdentures in the mandibular symphysis: the titanium plasmasprayed screw technique. Journal of Oral Implantology 1990;16: 265–71.

27. Tarnow DP, Emtiaz, S and Classi A.Immediate loading of threaded implants at stage 1 surgery in edentulous arches: ten consecutive case reports with 1- to 5-year data. International Journal of Oral and Maxillofacial Implants 1997; 12:319–24.

28. Horiuchi K, Uchida H, Yamamoto K and Sugimura M. Immediate loading of Branemark system implants following placement in edentulous patients: a clinical report. International Journal of Oral & Maxillofacial Implants 2000; 15:824–30.

29. Degidi M, Piattelli A, Iezzi G, Carinci F. Wide-diameter implants: analysis of clinical outcome of 304 fixtures. J Periodontol 2007; 78:52–58.

30. Artzi Z, Parson A, Nemcovsky CE. Wide-diameter implant placement and internal sinus membrane elevation in the immediate postextraction phase: clinical and radiographic observations in 12 consecutive molar sites. Int J Oral Maxillofac Implants 2003; 18:242–49.

31. Chiapasco M, Gatti C, Rossi E, Haefliger W and Markwalder TH. Implant-retained mandibular overdentures with immediate loading. A retrospective multicenter study on 226 consecutive cases. Clinical Oral Implants Research 1997; 8:48–57.

32. Adell R, Lekholm U, Rockler B, Bra°nemark P-I. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1981; 10:387–416.

33. Lioubavina-Hack N, Lang NP, Karring T. Significance of primary stability for osseointegration of dental implants. Clin Oral Implants Res 2006; 17:244–50.

34. Rosenquist B, Grenthe B. Immediate placement of implants into extraction sockets: implant survival. Int J Oral Maxillofac Implants 1996; 11:205–09.