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Clinical Evaluation of Complications in Implant-Supported Dentures: A 4-Year Retrospective Study

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Background: Implants that can be used in the prosthetic rehabilitation of full and partial edentulous patients are now frequently used due to advances in dentistry. Despite advanced methods of applications, failures and complications can still be seen. The aim of our study was to evaluate clinical prosthetic values and complications that occurred during 4-year follow-up in implant-supported restorations.

Material/Methods: This retrospective study included 40 patients who received oral rehabilitation with an implant-supported prosthesis. A total of 162 implants were placed: 99 in the maxilla and 63 in the mandible. The prosthetic and surgical data were recorded. Data including prosthetic complications and implant loss were recorded and statistically analyzed using Cox proportional hazard regression analysis.

Results: In total, 159 implants (98.14%) survived, 3 implants (1.86%) failed, and 100% of the protheses were successful. There were 62 dental implants used as abutments for removable dentures and 97 for fixed dentures. The most frequent prosthetic complications after placement of an implant-supported prosthesis were loss of retention, mucositis, abutment screw loosening, and fracture. Patient satisfaction after prosthesis use was also evaluated, showing that satisfaction was systematically increased.

Conclusions: To minimize the frequency of complications, protocols must be established from diagnosis to the completion of treatment and follow-up of implant-supported prostheses, especially in terms of adequate technical steps and careful radiographic evaluation of the components.

MeSH Keywords: Dental Implantation • Dental Implants, Single-Tooth • Dental Impression Technique

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Background

One of the main challenges faced by dentists has been replacing missing teeth to the satisfaction of their patients. Implant therapy is a basic and durable option for replacing missing teeth [1–3].

In addition to aesthetic and phonetic improvements, prostheses are required for chewing ability; otherwise, nutrient intake is severely restricted and can result in many health complications. Implant-supported dentures improve the biomechanical integration of the dentures by providing them with a better retention and also increase the biting force by partially relieving the gingivo-mucosal support of occlusal loads [4]. The maximum occlusal force of patients with dentures can by improve 300% with an implant-supported prosthesis [1].

It is clearly established that patient quality of life is increased after implant treatment. Many of the material and application methods developed do not completely prevent failed applications. As a result, early and late complications are unavoidable [5,6]. While contemporary implant dentistry provides the clinician with a wide variety of restorative options, understanding the possible long-term complications arising from such procedures is important [2,7].

In various clinical trials, the long-term prognosis and predictability of implant-supported prostheses is well documented [8]. However, researchers do not yet fully understand the etiology of implant complications. During the past 2 decades, one of the major interests in implant research has been the success and/or failure of implants from a biological point of view. More recently, implant research has focused on factors affecting prosthetic outcomes and patient satisfaction with treatment [2,3,9].

The purpose of this retrospective study was to assess the main problems reported by patients and observed by professionals after prosthetic rehabilitation.

Material and Methods

This retrospective study included patients with implants in the partially or totally edentulous upper and/or lower jaws treated with fixed or removable dentures in the Department of Oral surgery and Prosthodontics of the Dicle University Dentistry Faculty between January 2011 and February 2012. The study included 25 women and 15 men (mean age 50.27 years; range, 25–75 years) who received fixed dentures with 97 implants (61%) and removable dentures with 62 implants (38.9%). Five of these patients received both fixed and removable implant-supported prosthesis (Table 1). All patients were questioned and examined clinically and radiographically and follow-up controls were performed regularly. Orthopantographic and cone-beam computer tomographic examinations were routinely carried out.

A total of 162 implants were placed: 99 in the maxilla and 63 in the mandible. In total, 159 implants (98.14%) survived and 3 implants (1.86%) failed. There were 2 (1.26%) cases of early implant failure and 1 (0.62%) cases of late implant failure; 100% of the protheses were successful.

The potential confounders age, recipient site, smoking, periodontal disease, and oral status were recorded. Descriptive statistics were used for each patient, such as patient systemic factors, habits, plaque index, gingival index, denture modalities, prosthetic complications, and the degree of patient satisfaction.

In our study, the distribution of prosthetic failures according to years was examined retrospectively, such as loss of retention, mucositis, abutment screw loosening or fracture, denture-ceramic fractures, and peri-implantitis. The significance of the effect of the examined parameters in the total patient group was examined by the Cox proportional hazards method.

A total of 159 dental implants, including 2 different dental implant brands, were examined (Dyna: Holland; Biohorizons, Birmingham, AL). Implants were placed according to the manufacturer's surgical protocol. The implant system was chosen randomly, but each patient received only 1 system. Complications seen at 12, 24, 36, and 48 months after prosthetic treatment were evaluated.

Results

Patient data, including the implant location, opposing occlusion, risk factors, type of the prosthesis, and failed implants, are listed in Table 1. There were 159 dental implants. The healing period was completed without any complication, except for 3 implants in 3 cases and the average percentage of success was 98.14%. The loss rate in the dental implants placed in the upper jaw was 0.62%, while the loss rate in the lower jaw was found to be 1.26%. The implant success rate and the prosthetic success rate were very high. The number of implants in each jaw is shown in Table 2.

Complications of implant-supported fixed and removable prosthetic restorations within the 4-year period since the construction phase are shown in Table 3. Loss of retention for implant-supported fixed prosthesis describes the loss of cementation and explains the loss of retention for removable implant-supported prostheses. Loss of retention in removable prostheses

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Table 1. Patient characteristics.

No of patients	Age/Sex	Implant location	Opposing occlusion	Risk factors	Type of prosthesis	F. Im
1	45/F	Mx-a 3, Mx-p 4	Natural teeth	N	Fixed prosthesis	N
2	52/M	Mx-a 2	Combination	N	Ind. attach overdenture	N
3	52/M	Md-a 3	Combination	N	Ind. attach overdenture	Y
4	70/M	Mx-p 2	Fixed prosthesis	N	Fixed prosthesis	N
5	60/M	Mx-a 2, Mx-p 2, Md-a 2, Md-p 4	Combination	N	Fixed p. + imp supp. remov. p.	N
6	55/M	Mx-a 3, Mx-p 4, Md-a 4	Combination	Smoking	Fixed p. + ind. att. overdenture	Y
7	45/M	Mx-a 3, Md-a 3	Combination	N	Fixed prosthesis	N
8	35/F	Md-p 1	Natural teeth	N	Impl. suppor. single crown	N
9	38/F	Mx-p 1, Md-p 1	Natural teeth	N	Impl. suppor. single crown	N
10	64/F	Md-a 2	Complete denture	Smok., ostep.	Ind. attach overdent	N
11	47/F	Mx-a 3, Mx-p 3	Combination	N	Fixed prosthesis	N
12	49/F	Mx-a 4	Fixed Prosthesis	N	Ind. attach overdenture	N
13	41/F	Mx-p 3, Md-p 2	Fixed Prosthesis	N	Fixed prosthesis	N
14	75/M	Mx-a 2, Mx-p 2	Combination	N	Ind. attach overdenture	N
15	57/F	Mx-a 2, Mx-p 1	Combination	Diabet	Ind. attach overdenture	Y
16	50/F	Mx-a 2	Natural teeth	N	Ind. attach overdenture	N
17	45/F	Mx-p 4, Md-p 1	Combination	N	Fixed prosthesis	N
18	68/F	Md-a 2	Complete denture	Osteoporos	Ind. attach overdent	N
19	40/F	Mx-p 1	Natural teeth	Smoking	Impl. suppor. single crown	N
20	54/F	Mx-a 2, Mx-p 3, Md-a 4	Combination	N	Fixed p. + ind.att. overdenture	N
21	44/F	Md-p 4	Fixed Prosthesis	N	Fixed prosthesis	N
22	75/F	Md-p 2	Combination	Diabet	Ind. attach overdent	N
23	55/F	Md-p 4	Combination	Smoking	Imp supp. remov. p.	N
24	25/F	Mx-a 2	Natural teeth	Smoking	Fixed prosthesis	N
25	58/F	Mx-a 2, Md-a 2, Md-p 2	Combination	N	Fixed p. + ind. att. overdenture	N
26	76/M	Mx-a 2, Mx-p 2	Combination	Diabet	Ind. attach overdenture	N
27	43/F	Mx-p 3	Natural teeth	N	Fixed prosthesis	N
28	52/F	Mx-a 2	Fixed prosthesis	Diabet	Ind. attach overdenture	N
29	60/M	Mx-p 4	Fixed prosthesis	Smoking	Fixed prosthesis	N
30	29/F	Mx-p 1	Natural teeth	Smoking	Impl. suppor. single crown	N
31	48/M	Mx-p 6, Md-p 2	Combination	N	Fixed prosthesis	N
32	50/M	Md-a 3	Combination	N	Ind. attach overdenture	N
33	66/F	Md-a 2	Complete denture	Diab, osteop	Ind. attach overdenture	N
34	42/M	Mx-p 4	Combination	Smoking	Fixed prosthesis	N
35	45/M	Md-p 3	Fixed Prosthesis	N	Fixed prosthesis	N
36	43/F	Mx-a 2	Fixed Prosthesis	N	Fixed prosthesis	N
37	27/M	Mx-p 2, Md-p 2	Fixed Prosthesis	Smoking	Fixed prosthesis	N
38	52/M	Mx-a 2, Mx-p 2, Md-a 2	Combination	Diab, smok.	Fixed p. + ind. att. overdenture	N
39	30/F	Mx-a 2, Mx-p 2, Md-p 2	Combination	Smoking	Fixed prosthesis	N
40	49/F	Md-a 2, Md-p2	Complete denture	N	Ind. attach overdenture	N

Mx – maxilla; Md – mandible; a – anterior; p – posterior; F – female; M – male; N – no; Y – yes; F. imp – failed impl.; Ind. attach overdent – individual attachment overdenture; Combination – fixed prosthesis + removable prosthesis + natural teeth; Imp supp. remov. p. – implant-supported removable prosthesis.

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Table 2. Distribution of type of prosthesis every implant no. per jaw.

Implant no. per jaw	1	2	3	4	5	6	7
Fixed prosthesis	6	9	5	6	1	3	2
Removable prosthesis	0	8	3	9	0	0	0

Table 3. Frequency of prosthetic complications and maintenance n (%) of patients.

	Loss of retention	Abutment screw loosening-fracture	Mucositis	Denture-ceramic fracture	Peri-implantitis
1 year	13 (32.5)	6 (15)	16 (40)	2 (5)	2 (5)
2 year	11 (27.5)	8 (20)	9 (22.5)	1 (2.5)	1 (2.5)
3 year	17 (42.5)	7 (17.5)	10 (25)	3 (7.5)	0 (0)
4 year	22 (55)	9 (22.5)	7 (17.5)	1 (2.5)	1 (2.5)

Table 4. Cox proportional hazard regression analysis.

Variable (reference)	Risk	B	Hazard ratio	95% confidence interval
Fixed prosthesis	Loss of retention	0.840	P=0.002; HR=0.432	0.25–0.74
Removable prosthesis	Mucositis	0.916	P=0.005; HR=0.400	0.20–0.78

Table 5. Plaque index (Silness & Löe).

	0		1		2		3	
	n	%	n	%	n	%	N	%
1 year	6	15	19	47.5	12	30	3	7.5
2 year	7	27.5	22	55	10	25	1	2.5
3 year	11	27.5	15	37.5	9	22.5	5	12.5
4 year	10	25	17	42.5	11	27.5	2	5

indicates problems in retaining systems. Problems in the retaining system may require the relining of the prosthesis and the need for various repair procedures.

The most common complications were: loss of retention, mucositis, abutment screw loosening, or fracture. Failure and complications were less common in fixed prosthetic restorations except for denture-ceramic fracture. During the 4-year follow-up, denture-ceramic fractures were not seen in removable prosthesis. Some prostheses demonstrated more than 1 complication. No statistically significant differences were found in other complications. Wilcoxon signed ranks testing showed no statistically significant differences in complication rates between the 1st and 4th years.

The significance of the effect of the complications followed for 4 years on the total patient group was examined by the Cox proportional hazard analysis. The risk probabilities of these significant variables were assessed. Complications were studied at a level of significance of $p<0.05$, and the complications below this value, retention loss and mucositis, were significant and were considered as a risk group. The risk of loss of retention in implant-supported fixed prostheses is 43.2% that of the risk in removable dentures. The rate of mucositis risk in implant-supported removable prostheses was significantly higher than that of fixed prostheses ($p<0.05$). This risk was 40% that of the risk in fixed prostheses (Table 4).

The plaque index values of the individuals participating in the study are shown in Table 5. Table 6 shows the distribution of gingival index values according to years. The difference between gingival index and plaque index was not significant in patients with removable prosthesis and in those with fixed prosthesis ($p>0.05$).

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Table 6. Gingival index (Löe & Silness).

	0		1		2		3	
	n	%	n	%	n	%	N	%
1 year	15	37.5	12	30	11	27.5	2	5
2 year	10	25	15	37.5	12	30	3	7.5
3 year	11	27.5	12	30	10	25	7	17.5
4 year	13	32.5	14	35	9	22.5	4	10

Table 7. Patient satisfaction before treatment and 4 years after treatment.

	Satisfaction before treatment (1–5)	Satisfaction after treatment (1–5)
Mean	1.38	4.60
Standard deviation	0.54	0.63

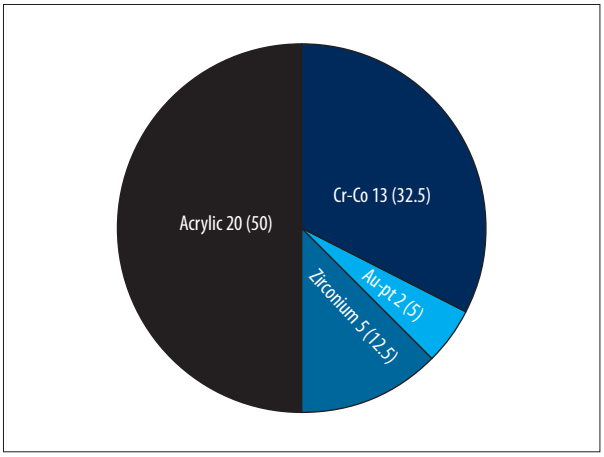

Figure 1. Denture modalities n (%).

Patient satisfaction was measured by questionnaire, using a discrete scale of 1 to 5 (1 was the worst). Satisfaction levels were recorded before prosthesis delivery and 4 years after. Patient satisfaction is summarized in Table 7. The *t* test was used to compare quantitative variables and it appears that satisfaction was systematically increased. All patients were more comfortable after treatment than before. Eating and phonetic problems that were initially seen disappeared after a short adaptation period.

The majority of the fixed prostheses were metal-based dentures (13; 32.5%) compared to only 5 zirconium dentures (12.5%) (Figure 1).

Discussion

Implant applications in recent years have become quite widespread in dentistry and there are many reasons for complications and failures that may arise. It is not possible to calculate the overall incidence of complications for implant prostheses. However, recent studies indicate that there are many clinical complications associated with implant prostheses. Studies that present prosthodontic success criteria in implant dentistry are limited, representing approximately 27% of all publications on implant success [2,10]. In the literature, complications of implant prostheses were identified in 6 categories: surgical complications, bone loss, implant loss, mechanical complications, peri-implant soft tissue complications, and esthetic/phonetic complications [6,11].

Despite the limitations of retrospective studies, the outcomes may provide information about prosthetic complications and failures. Many researchers have conducted retrospective and prospective studies on the distribution of different failures over the years and reported different rates [12]. In some studies, implant loss and success rates were evaluated before and after loading in cases with 5-year follow-up, and according to this, losses before loading were found to be between 2.5% and 2–5% after [10,13]. The survival rates of various implants have increased in recent years, with reported rates of 83–97% [14]. In the present study, a total 159 implants (98.12%) survived, and 3 implants (1.88%) failed during a mean follow-up period of 48 months. There were 2 (1.26%) cases of early implant failure and 1 (0.62%) case of late implant failure. Most failures occurred early, so recognition of potential risk factors of early failure is important. Early failure of dental implants is thought to be caused by failure of bony healing around the implant and subsequent failure of osseointegration; this could be due to local or systemic factors [15].

The complications are very important for the patient and the physician in terms of treatment success [12,16]. Carlson and Carlsson reviewed the complications following tooth restoration

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with osseointegrated implants. The range of complications reported was very wide, from the need to make a small adjustment to the preparation of a new prosthesis [17]. The results of the present study showed the most important ones from prosthetic complications that may arise after dental implant construction are those that can completely affect the future of the prosthetic structure: mucositis, loss of retention, abutment screw loosening or fracture, denture-ceramic fracture, and peri-implantitis.

Good dental hygiene is important for preservation of the implant [11,18], but it is not possible to say exactly whether the loss of the implant is due to mucositis or peri-implantitis. Many researchers have found no relationship between periodontal health and implant failure [19–21]. However, some studies reported that there is a relationship between poor oral hygiene or lack of connected gingiva and implant failure [22–24]. In the implant patients we followed, mucositis was one of the most common complications, which affected 40% of the cases (n: 16). Mucositis and peri-implantitis can be detected in many cases due to difficulties in clearing the implanted region. After hygiene training in some studies, there were slight decreases in hygiene problems in periodic follow-ups. We also think that the high prevalence of mucositis in our study cases is due to inappropriate oral hygiene.

The term "mucositis" is usually used to describe a periodontal reversible inflammatory reaction without bone loss. It is equivalent to periodontal gingivitis, and is characterized by pain, gingival bleeding, erythema, and ulceration [19]. The key to prevention is careful oral hygiene, but if mucositis has already developed, the treatment depends on the degree and extent of the infection [16,18,19]. When gingivitis is caused by improper oral hygiene, as in our study, it is best to provide oral hygiene education. If the symptoms persist, the prosthesis can be removed and adjusted to prevent the buildup of plaque. An antiseptic mouthwash can be used to kill bacteria and reduce symptoms [16]. Peri-implantitis can occur in the same manner as with food and bacterium accumulation under the acrylic prosthesis. In some cases, there may be mechanical stress caused by a lack of passive fit of the metal structure or malocclusion. There is limited information on the incidence of peri-implantitis, and the term was included in only a few studies [13]. The best treatment for these cases is to remove the prosthesis and then perform curettage with irrigation. Regular checkups are recommended every 6 or 12 months to avoid complications and to assess the status of peri-implant tissue. There is a consensus on the definition and prediction of short-, medium-, and long-term prosthetic care requirements for better communication with the patient, efficiency, and cost control [16,20,24]. We also think that the and treatments done at our regular checkups reduce the risk of mucositis and peri-implantitis.

Nedir et al. carried a comparison between the fixed prosthesis and the removable prosthesis on implants, reporting that the removable prosthesis had many more complications than in the fixed prosthesis, and that these complications also recurred later [25]. This is consistent with our results. In the present study, the most common complication after mucositis for removable implant prostheses were retention and lack of stability. The loss of attachment retention, either due to its absence or from malfunction, may have caused these problems. Thus, patients should be advised to have attachments evaluated regularly.

In our study, loss of cement was observed in 5 patients in the first year and 6 patients in the fourth year. Among the fixed implant-retained prostheses, it was observed that crown cementation with a definitive cement was 4 times more successful than using an interim cement.[2] Cement failure and abutment screw loosening commonly affect the prostheses attachment. After screw loosening, micro-movements of the restoration under load conditions may irritate the peri-implant tissues; this is relatively easily remedied by recementing the prostheses to the implant or by tightening or replacing the abutment screw, but it is very inconvenient for the patient and the dentist. However, if the screw cannot be retrieved or if it is fractured, an extensive repair, such as disuse of the involved implant or remake of the prosthesis, becomes critical [26].

Rates reported for abutment screw loosening or fracture vary. It has been reported that this ratio varies between 1–22% in retrospective studies [13]. The findings obtained in our study confirm this. Abutment screw loss in single-tooth implants was 10% at 4-year follow-up. This rate is very low in implant-supported multi-member restorations. The periodic control is the most important preventive measure for reducing screw problems, but such problems may be attributable to differences in the type of abutment, the implant system, and the initial torque [12]. In the first 5 years of function, implant fracture was a rare complication and occurs in less than 1% of all implants [2,3,11,13]. In agreement with these results, we did not encounter this complication in our patients during the 4-year follow-up period.

We found that most of the patients were more comfortable after treatment than before treatment, and all of them reported that their functional, chewing, and phonetic abilities improved. This increase in satisfaction was probably due to the comfort of the prosthesis and the improved esthetics resulting from the rehabilitation.

A limitation of our study was the low participation rate of individuals receiving treatment with an implant-supported prosthesis. We believe that better results can be achieved if the participation rate can be increased to over 1 year.

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Conclusions

Further work is needed on implant complications and prevention of these complications. For example, complications due to retaining cement loosening suggest that more studies should be done on biomechanical and restraint factors in implant-based structures. We believe it is crucial to study the patient not only from a surgical point of view, but also from the prosthodontic perspective, as an indication of incorrect prosthesis can have an unacceptable level of complications. In implant-supported dentures, planning of treatment in advance is crucial, and routine control of the dentures after treatment is completed is of great importance. The best way to manage complications is to prevent them in the first place. More studies are required to assess the causes and effects of complications.

References:

1. Karabuda C, Yaltırık M, Bayraktar M: A clinical comparison of prosthetic complications of implant-supported overdentures with different attachment systems. Implant Dentistry, 2008; 17(1): 74–79
2. Loza-Herrero MA, Rivas-Tumanyan S, Morou-Bermudez E: Success and complications of implant-retained prostheses provided by the post-doctoral prosthodontics program, University of Puerto Rico: A cross-sectional study. J Prosthet Dent, 2015; 114(5): 637–43
3. Gervais MJ, Wilson PR: A rationale retrievability of fixed implant-supported prostheses: A complication-based analysis. Int J Prosthodont, 2007; 20: 13–24
4. Waddell JN, Ichim I, Lee H et al: Fatigue failures of bar-attachment brazed joints for implant-supported overdentures. Engineering Fract Mechan, 2007; 74: 1148–59
5. Abduo J, Bennani V, Waddell N et al: Assessing the fit of implant fixed prostheses: A critical review. Int J Oral Maxillofac Implants, 2010; 25(3): 506–15
6. Misch CE: Translation editor: Kutay Ö. Dental implant prosthetics. İstanbul: Nobel Medical Bookstore, 2009; 1–15, 414–49
7. Froum SJ: Translation editor: Arıkan F, Günbay T, Kazazoğlu E. Dental implant complications: Etiology, prevention and treatment. In: Goodacre CJ, Kattadiyil MT. İstanbul: Express Bookstore, 2013; 1–6, 110–17, 119–26, 172–95
8. Chang HS, Hsieh YD, Hsu ML: Long-term survival rate of implant-supported overdentures with various attachment systems: A 20-year retrospective study. J Dent Scien, 2015; 10: 55–60
9. Çetiner S, Zor F: The critical factors effecting the success of dental implants. The Journal of Gazi University Faculty of Dentistry, 2007; 24(1): 51–56
10. Pjetursson BE, Asgeirsson AG, Zwahlen M et al: Improvements in implant dentistry over the last decade: Comparison of survival and complication rates in older and new publications. Int J Oral Maxillofac Implants, 2014; 29(Suppl.): 308–24
11. Goodacre CJ, Bernal G, Rungcharassaeng K et al: Clinical complications with implants and implant prostheses. J Prosthet Dent, 2003; 90: 121–32
12. Pişkin B, Gökçe HS, Avsever H et al: Prosthetic complications in implant supported fixed prosthesis. A four year multi-center retrospective analysis. The Journal of Istanbul University Faculty of Dentistry, 2010; 44(2): 75–80
13. Berglundh T, Persson L, Klinge B: A systematic review of the incidence of biological and technical complications in implant dentistry reported in prospective longitudinal studies of at least 5 years. J Clin Periodontol, 2002; 29(3): 197–212
14. Hasegawa T, Kawabata S, Takeda D et al: Survival of Branemark System Mk III implants and analysis of risk factors associated with implant failure. Int J Oral Maxillofac Surg, 2017; 46: 267–73
15. Baqain ZH, Moqbel WY, Sawair FA: Early dental implant failure: Risk factors. Br J Oral Maxillofac Surg, 201; 50(3): 239–43
16. Real-Osuna J, Almendros-Marques N, Gay-Escoda C: Prevalence of complications after the oral rehabilitation with implant-supported hybrid prostheses. Med Oral Patol Oral Cir Bucal, 2012; 17(1): e116–21
17. Carlson B, Carlsson GE: Prosthodontic complications in osseointegrated dental implant treatment. Int J Oral Maxillofac Implants, 1994; 9: 90–94
18. Liaw K, Delfini RH, Abrahams JJ: Dental implant complications. Semin Ultrasound CT MRI, 2015; 36: 427–33
19. Ouirynen M, Naert I, Van Steenberghe D et al: Periodontal aspects of osseointegrated fixtures supporting an overdenture. A 4-year retrospective study. J Clin Periodontol, 1991; 18: 719–28
20. Apse P, Zarb GA, Schmitt A et al: The longitidunal effectiveness of osseointegrated dental implants. The Toronto study: Peri-implant mucosal response. Int J Periodontics Restorative Dent, 1991; 11: 94–111
21. Weber HP, Crohin CC, Fiorellini JP: A 5-year prospective clinical and radiographic study of non-submerged dental implants. Clin Oral Implants Res, 2000; 11: 144–53
22. Salonen MA, Oikarinen K, Virtanen K et al: Failures in the osseointegration of endosseous implants. Int J Oral Maxillofac Implants, 1993; 8: 92–97
23. Lindquist LW, Carlsson GE, Jemt T: A prospective 15-year follow-up study of mandibular fixed prostheses supported by osseointegrated implants. Clinical results and marginal bone loss. Clin Oral Implants Res, 1996; 7: 329–36
24. Tang Z, Sha Y, Lin Y et al: Peri-implant mucosal inflammation and bone loss: Clinical and radiographic evaluation of 108 dental implants after 1-year loading. Clin J Dent Res, 2000; 3: 15–20
25. Nedir R, Bischof M, Szmukler-Moncler S et al: Prosthetic complications with dental implants: From an up-to-8-year experience in private practice. Int J Oral Maxillofac Implants, 2006; 21: 919–28
26. Montero J, Manzano G, Beltran D et al: Clinical evaluation of the incidence of prosthetic complications in implant crowns constructed with UCLA castable abutments. A cohort follow-up study. J Dent, 2012; 40: 1081–89

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