■ Eser ELEMEK[1] · · · · · · · · · · · · · · ID

CORRESPONDANCE

[1] Eser ELEMEK

Phone : +905324005338
e-mail : eelemek@gelisim.edu.tr

Received : Aug 29, 2022
Accepted : Nov 27, 2022

[1] Gelisim University, Faculty of Dentistry,
Periodontology Department, Istanbul, Turkey

RESEARCH

RETROSPECTIVE ANALYSIS OF GERIATRIC PATIENTS TREATED WITH DENTAL IMPLANTS AND IMPLANT-RETAINED PROSTHESES

ABSTRACT

Introduction: An increasing number of geriatric patients are being treated with dental implants instead of the conventional complete dentures for enhanced oral health-related quality of life. Therefore, this retrospective study assessed the survival rates and biological and technical complications of implants placed in partially and completely edentulous geriatric patients.

Materials and Method: Thirty-six elderly patients (65–80 years) rehabilitated with 105 dental implants and undergoing maintenance therapy at our private practice were included. Demographic data, including patient age, sex, systemic condition, and smoking status, were recorded. The new classification was used to define peri-implant status which was assessed based on bleeding on peri-implant probing, probing depth, suppuration, and peri-implant bone loss. Additionally, the cleanability of the prosthesis, screw-loosening, ceramic chipping, fracture of prosthesis, and their relationship with peri-implantitis were evaluated.

Results: The mean age of the patients at implant surgery was 67.8±3.3 years. The implant survival rate was 100% during the mean observation period of 38±26.5 months. Forty-two (40%) implants were diagnosed as healthy, 52 (49.5%) as having peri-implant mucositis, and 11 (10.5%) as having peri-implantitis. Smoking and poor oral hygiene were significantly associated with peri-implantitis (p<0.01). Peri-implantitis was also significantly more common around implants in function for >3 years (p<0.01).

Conclusion: According to new classification, peri-implantitis is not common in geriatric patients. Implant treatment and implant-retained prostheses can be safely used to improve the quality of life of elderly patients. However, clinicians should plan the surgery and prepare the prosthesis carefully as elderly people may need nursing or domiciliary dental care.

Keywords: Peri-Implantitis; Geriatric Dentistry; Oral Health; Quality of Life.

INTRODUCTION

Poor oral hygiene can cause caries, loss of periodontium, and ultimately, tooth loss (1). In the last few decades, dental implants have been the choice of treatment for tooth loss; they are placed in the bone to act as abutments for fixed or overdenture prostheses as an alternative to conventional removable ones. Dental implants have a reported 10-year survival rate of >95% in both partially and completely edentulous patients (2). Owing to the predictability and high survival rates of dental implants, their use in geriatric patients has been encouraged for improved oral health-related quality of life (3).

The use of implant-supported fixed and overdenture prostheses could enhance the chewing ability, social reintegration, and psychological well-being of geriatric patients (4). However, in geriatric patients, the presence of systemic conditions such as cardiovascular disease, diabetes mellitus, neurocognitive impairment (Alzheimer's disease and dementia), and loss of manual force and dexterity can jeopardize the healing and make dental implant therapy challenging (5). The surgical process, healing period during osseointegration, and survival rate of the implant should be carefully considered in this age group. Pathology in periodontium is inevitable in elderly individuals due to the loss of physiological integrity and impaired function. According to the recent ITI consensus report, implant therapy is not contraindicated in geriatric patients; however, comorbidities and autonomy should be considered (6).

Peri-implant mucositis is defined as the presence of inflammation in the peri-implant mucosa, and peri-implantitis is characterized by the loss of supporting bone in addition to the mucosal inflammation (7). Poor oral hygiene, history of periodontitis, cigarette smoking, lack of compliance during supportive periodontal therapy, and prosthesis-related factors (lack of cleanability and inappropriate fit of the implant-supported prosthesis) are established risk factors for peri-implant diseases (8). Technical complications, such as wear, chipping, fracture of the prosthetic material, and screw loosening, may also arise in patients with implant-supported prosthesis (9). The occurrence of technical complications is time dependent and may increase the chair-side time and affect the patients' quality of life (10).

Little information is available regarding the prevalence of peri-implantitis in geriatric patients. In most cases, peri-implant diseases are asymptomatic and are not perceived by patients (11). Peri-implantitis may also cause clinical symptoms such as bleeding, suppuration, and swelling (7,9). When left untreated, peri-implantitis eventually leads to implant failure. In patients aged ≥65 years, the prevalence of moderate or severe periodontitis is reported as 64% whereas, the corresponding value for peri-implantitis is 30% within the same age group (12). The management of peri-implantitis may be more complicated in geriatric patients because of the possible progression of the existing systemic disease, multimorbidity, and dependency for daily activities (13,14). Therefore, further treatment with maintenance therapy should be carefully planned in older individuals. Few studies have investigated the effect of preventive maintenance therapy on implant survival in geriatric patients. According to a systematic review, implant survival in patients >65 years is 96.3% and 91.2% at 3 and 10 years, respectively (15). A study on 133 patients aged >80 years reported a 5-year cumulative survival rate of 92.6%–99.7% in both jaws (12).

There is a limited data on the use of implant-supported fixed or overdenture prostheses and the complications affecting the quality of life in geriatric patients. Therefore, this study aimed to evaluate peri-implant health and disease, technical complications, and their relationship with peri-implantitis and implant survival in geriatric patients.

MATERIALS AND METHOD

This retrospective study included 113 dental implants of 40 patients who visited our private prac-

tice between October 2014 and July 2020 based on the following inclusion criteria: age >65 years, use of implant-supported prostheses for at least 6 months, and ongoing maintenance therapy. Four patients did not attend any of the follow-up visits. Therefore, the data of 105 dental implants of 36 patients were evaluated. The study design was approved by the local ethics committee of Gelişim University (2022/11-47). Informed consent was obtained from all patients at initial examination. The study was conducted according to principles stated in the Helsinki Declaration.

Data collection:

Demographic information regarding age, sex, general health status, medication, and smoking status was collected. Tooth loss resulting in partial or total edentulism was recorded. Clinical examinations were performed using a periodontal probe with a 0.5 mm diameter (University of North Carolina PCPUNC15, Hu Friedy Ins. Co, USA). Bleeding on peri-implant probing was assessed as the presence or absence of bleeding observed 30 s after probing and calculated as a percentage for each implant. Suppuration and peri-implant probing depths were also evaluated. To determine the peri-implant bone loss, digitalized panoramic radiographs were examined using the Image J program (Wayne Rasband, National Institute of Health, USA). The magnification was calculated by comparing the known implant length and that measured using the program. Bone loss on the mesial and distal sides of the implant was recorded in millimeters, and the most-affected side was used to diagnose peri-implantitis.

Definition of peri-implant diseases:

The new classification of periodontal and peri-implant diseases and conditions was used to define the peri-implant condition (1);

Peri-implant health: absence of signs of inflammation and bleeding on probing with normal or reduced bone support

Peri-implant mucositis: bleeding on probing with signs of inflammation

Peri-implantitis: radiographic evidence of bone loss ≥3 mm and/or probing depth ≥6 mm in conjunction with profuse bleeding (16).

Additionally, adherence to oral hygiene was evaluated by observational and behavioral (self-reported or observed behaviors, such as changes in toothpaste weight) outcomes and defined as inadequate in the absence of proper brushing and interdental cleaning (17). Implant survival, prosthesis cleanability, and technical complications (ceramic chipping, fracture, and screw loosening) were also recorded.

Statistical analysis:

Data analysis was performed using Statistical Package for Social Sciences (SPSS Inc., Release 24.0, for Windows, Chicago, IL, USA). Descriptive statistics (minimum and maximum values, median, mean, and standard deviation) were used to present the demographic information. Analysis of variance was applied to the three groups (peri-implant health, peri-implant mucositis, and peri-implantitis) with normal distribution, and Kruskal–Wallis H test was performed in the absence of normal distribution. To evaluate differences within groups, Bonferroni correction was performed (p = 0.05/3=0.016). Because the number of patients was small, the data were analyzed only at the implant level. The chi-square test was used to compare the data between the two groups. Pearson's correlation was used to examine the relationship between the variables and peri-implantitis.

RESULTS

Thirty-six patients (20 women and 16 men) with 105 implants were included in the data analysis. Their mean age was 67.8±3.3 years at implant surgery. If more than one surgery was performed, the age at the first surgery was used. Of the 36 patients, 8 (22.2%) had diabetes and 10 (27.8%) were smokers.

The mean number of teeth lost at the time of implant placement was 12.8±13. Thirty-two (88.8 %) patients had partial edentulism (Table 1).

Implant characteristics in relation to peri-implant health and disease

A total, 105 dental implants were evaluated in this study. Six of them (5.7%) supported overdentures, whereas most implants (94.3%) supported fixed prosthetic restorations. No implant failure was observed during the mean observation period of 38±26.5 months. The survival rate was 100%. Forty-two (40%) of the implants were diagnosed as healthy, 52 (49.5%) as having peri-implant mucositis, and 11 (10.5%) as having peri-implantitis. The data on peri-implant health and disease are presented in Table 2. The mean observation time and marginal bone loss were greater for the implants with peri-implantitis (p<0.05). Poor oral hygiene was

Table 1. Demographic data of elderly

Variable	
Mean age (years)*	67.8±3.3
Gender** Female Male	 20 (55.5%) 16 (44.5%)
Diabetes** Yes No	 8 (22.2%) 28 (77.8%)
Smoking habit** Yes No	 10 (27.8%) 26 (72.2%)
Tooth loss* (number)	12.8±13
Edentulism** Partial Total	 32 (88.8%) 4 (11.2%)

*Mean and standard-deviation

**n (%)

Table 2. Characteristics of study sample regarding peri-implant health and disease

	Peri-implant health (n=42)	Peri-implant mucositis (n=52)	Peri-implantitis (n=11)	p
Mean observation time (months) ±SD	24.1±23.7	44.3±24.9	61±15.7	**<0.01***
BOP (%)	-	52 (100)	11 (100)	0.42**
Suppuration (%)	-	13 (25)	6 (54.5)	0.34**
Mean PD (mm) ±SD	2±0.5	3±0.7	5.6±0.5	0.06*
Mean MBL (mm) ±SD	0.3±0.5	1.2±0.8	4.1±0.4	**0.02***
Prosthetic restoration Fixed Overdenture	 42 (100%) -	 49 (94.2%) 3 (5.8%)	 8 (72.7%) 3 (27.3%)	 0.52**
Cleanability of prosthesis Yes	 41 (97.6%)	 44 (84.6%)	 11 (100%)	 0.31**
Poor oral hygiene Yes	 8 (19%)	 34 (65.3%)	 4 (36.3%)	 **<0.01***
Screw loosening Yes	 5 (11.9%)	 18 (34.6%)	 1 (9%)	 0.62**
Ceramic chipping Yes	 2 (4.7%)	 13 (25%)	 1 (9%)	 0.42**

BOP: Bleeding on probing, PD: Probing depth, MBL: Marginal bone loss

* Kruskall-Wallis H test

**Chi-Square test

also significantly associated with peri-implantitis (p<0.01). Most prosthetic restorations (91.4%) were designed to enable proper oral hygiene, and minor technical complications, such as screw loosening and ceramic chipping, were observed in 24 (22.8%) and 16 (15.2%) of the implants, respectively.

As quality of life is affected by the progression of inflammation in the peri-implant tissues, the relationship between peri-implantitis and the other variables was evaluated (Table 3). Peri-implantitis was observed significantly more around implants

in smokers and implants in function >36 months (p<0.01). No significant association was found between peri-implantitis and the other variables (p>0.05).

DISCUSSION

This study aimed to assess peri-implant health and disease in elderly individuals to determine their quality of life. In patients aged ≥ 65 years, the survival rate of dental implants over a mean observation period of >3 years was 100%. Additionally,

Table 3. Correlation table

	Peri-implantitis			
	Absent	Present	r	p

Age
  65-70
  ≥70
	75 (87.2%)
	19 (100)
		11 (12.8%)
		-
			-0.16	0.10

Gender
  Female
  Male
	51 (86.4%)
	43 (93.5%)
		8 (13.6%)
		3 (6.5%)
			-0.11	0.24

Diabetes
  Present
  Absent
	20 (100%)
	74 (87.1%)
		-
		11 (12.9%)
			-0.16	0.09

Smoking habit
  Yes
  No
	24 (77.4%)
	70 (94.6%)
		7 (22.6%)
		4 (5.4%)
			0.25	**<0.01**

Tooth loss
  1-14
  15-28
	46 (95.8%)
	48 (84.2%)
		2 (4.2%)
		9 (15.8%)
			0.18	0.05

Observation time (months)
  6-36
  ≥36
	61 (98.4%)
	33 (76.7%)
		1 (1.6%)
		10 (23.3%)
			0.34	**<0.01**

Screw loosening
  Present
  Absent
	23 (95.8%)
	71 (87.7%)
		1 (4.2%)
		10 (12.3%)
			-0.11	0.25

Ceramic chipping
  Present
  Absent
	15 (93.8%)
	79 (88.8%)
		1 (6.3%)
		10 (11.2)
			-0.05	0.55

Overdenture prosthesis
  Present
  Absent
	3 (50%)
	91 (91.9%)
		3 (50%)
		8 (8.1%)
			0.31	0.6

Cleanability of prosthesis
  Yes
  No
	85 (88.5%)
	9 (100%)
		11 (11.5%)
		-
			0.10	0.28

Poor oral hygiene
  Yes
  No
	42 (91.3%)
	52 (88.1%)
		4 (8.7%)
		7 (11.9%)
			-0.05	0.6

peri-implantitis was observed in only 10.5% of the implants. The effect of implant-retained prostheses and removable dentures on the patients' quality of life has been evaluated before (18). Most studies showed that dental implants can be safely placed in geriatric patients and improve their quality of life (6,19). Consistent with the findings of these studies, we observed that implant-retained fixed or overdenture prostheses improve the patients' quality of life, have few biological and technical complications, and are therefore suitable alternatives to conventional removable dentures when treating geriatric patients.

Comparison of studies on peri-implant diseases is difficult because of the differences in methods and the criteria used to define health and disease. Peri-implant diseases were first defined in the year of 2008 in the consensus report from the 6th European Workshop on Periodontology (7). They defined peri-implantitis as the loss of implant-supporting bone in addition to mucosal inflammation. However, assessment of peri-implantitis based on its severity (probing depth and extent of bone loss) yielded substantial variance in its prevalence, from 11.3% to 47.1% (7). Owing to the discrepancy between studies and lack of a common definition of peri-implantitis, the American Academy of Periodontology and European Federation of Periodontology together developed a new classification system for periodontal and peri-implant diseases and conditions (1). In this study, the most recent classification was used to define peri-implant health and disease status. As a peri-implant inflammation decreases the life quality and may have a negative effect on systemic condition of a geriatric patient, a clinician should have a more accurate information before planning the treatment. Therefore, the adaptation of new classification overcomes the misdiagnosis of peri-implant diseases and gives us a more precise information. To date, very little information is available using the new classification to define peri-implantitis and its relation with other variables in geriatric patients.

Gündoğar et al (10) used the same criteria to define peri-implant diseases in geriatric patients, and found a peri-implantitis prevalence of 30% whereas the considered value was 10.5% in this study. They reported that the marginal bone loss increased with increasing observation time, as was also observed in the present study. The higher levels of peri-implantitis were attributed to the long observation period, which was between 24 and 56 months in their study.

The strict selection criteria for ongoing maintenance therapy resulted with the analysis of 105 implants despite six years of data collection. Seki et al (20) found survival rate as 94.6% at the implant level in 56 implants of 23 patients. Lee et al (21) investigated the effects of 118 implants in 35 geriatric patients with a mean period of 32.7 months and observed peri-implant bone resorption as 0.27 mm. The mean observation time was significantly associated with peri-implant disease than with peri-implant health in this study. Jemt et al (22) reported that, over a 9-year observation period, implants showed additional bone loss. In another study by Karlsson et al (23) 20% of the implants showed additional bone loss of >2 mm during an observation period of 3.3 years. In a systematic review by Dreyer et al (24), the incidence of peri-implantitis ranged from 0.4% within 3 years to 43.9% within 5 years. In this study, peri-implant health was observed at a mean follow-up of 2 years. However, peri-implant mucositis was diagnosed with greater frequency as the observation period increased (44 months), and peri-implantitis was significantly more prevalent around implants with a mean observation time of 5 years.

Oral hygiene has a significant effect on peri-implant health. Poor oral hygiene is a risk factor for peri-implant diseases (6). In this study, poor oral hygiene was significantly associated with peri-implantitis. Smoking is a known risk factor for peri-implant mucositis (8). Despite overwhelming research, its association with peri-implantitis is still accept-

ed as a potential risk indicator (25). Peri-implantitis was more prevalent in geriatric smokers than in non-smokers in this study. To determine the cumulative effect of smoking on peri-implantitis in geriatric patients, more studies with a larger sample are needed.

Implant-retained overdentures have been found to be superior to complete conventional dentures in terms of patient satisfaction and oral health-related quality of life (17,18,26). However, the number of implants supporting the overdenture prosthesis was insufficient (n=6) in the present study to further analyze the biological and technical complications. Likewise, among the implants with peri-implantitis, one had screw loosening and one had ceramic chipping. The low rates of technical complications did not allow a comparison in this study.

In geriatric patients, the survival of the implants was 100%, and only 11 implants (10.5%) with a mean follow-up of 5 years had peri-implantitis. Thus, it can be concluded that the 100% survival rate and considerably low values of peri-implantitis helped improve the quality of life of patients aged ≥65 years. The favorable outcomes may be attributed to the facts such as the presence of a single periodontist who performed the surgeries, the high cleanability (91.4%) of the prostheses, and the continued maintenance program. The inclusion criterion of strict maintenance program is one strength of this study as it gives the opportunity to analyze clinical and radiological examinations as well as the systemic condition. Besides, the use of a new peri-implant classification is also another strength of this study that makes it a pioneer one. Zitzmann and Berglundh (7) recommended that when evaluating peri-implant inflammation, data from private or public dental clinics, apart from university clinic data, should also be included. This study presents data on geriatric patients treated at a private practice which can be considered as another strength. However, the small number of patients is a limitation of this study more likely due to the strict maintenance program. Another limitation is that only implant-based data could be analyzed. In a patient with multiple implants, inflammation of even a single implant can worsen the quality of life. Therefore, studies on peri-implant health and disease in the elderly in a private practice setting should also be performed using subject-based data.

In conclusion, the survival rate of implants over a mean follow-up of >3 years was 100% in geriatric patients. The implementation of new classification yielded results of peri-implantitis as 10.5% in implant level. Poor oral hygiene, smoking, and implants in function for more than three years were found to be associated with peri-implantitis. Implants can be safely placed and maintained with good oral hygiene to improve the oral health-related quality of life of geriatric patients.

REFERENCES

1. G. Caton J, Armitage G, Berglundh T, et al. A new classification scheme for periodontal and peri-implant diseases and conditions – Introduction and key changes from the 1999 classification. J Clin Periodontol. 2018;45(20):S1-S8 (PMID: 29926489).

2. Buser D, Janner SFM, Wittneben JG, Brägger U, Ramseier CA, Salvi GE. 10-Year Survival and Success Rates of 511 Titanium Implants with a Sandblasted and Acid-Etched Surface: A Retrospective Study in 303 Partially Edentulous Patients. Clin Implant Dent Relat Res. 2012;14(6):839-51 (PMID: 22897683).

3. Gil-Montoya JA, Ponce G, Sánchez Lara I, Barrios R, Llodra JC, Bravo M. Association of the oral health impact profile with malnutrition risk in Spanish elders. Arch Gerontol Geriatr. 2013;57(3):398-402 (PMID: 23763959).

4. Schimmel M, Srinivasan M, McKenna G, Müller F. Effect of advanced age and/or systemic medical conditions on dental implant survival: A systematic review and meta-analysis. Clin Oral Implants Res. 2018;29(16):311-30 (PMID: 30328186).

5. Schimmel M, Müller F, Suter V, Buser D. Implants for elderly patients. Periodontol 2000. 2017;73(1):228-40 (PMID: 28000268).

6. Heitz-Mayfield LJ, Aaboe M, Araujo M, et al. Group 4 ITI Consensus Report: Risks and biologic complications associated with implant dentistry. Clin Oral Implants Res. 2018;29(16):351-58 (PMID: 30328181).

7. Zitzmann NU, Berglundh T. Definition and prevalence of peri-implant diseases. J Clin Periodontol. 2008;35(8):286-91 (PMID: 18724856).

8. Heitz-Mayfield LJA, Heitz F, Lang NP. Implant Disease Risk Assessment IDRA–a tool for preventing peri-implant disease. Clin Oral Implants Res. 2020;31(4):397-403 (PMID: 32003037).

9. Papaspyridakos P, Bordin TB, Kim YJ, et al. Technical Complications and Prosthesis Survival Rates with Implant-Supported Fixed Complete Dental Prostheses: A Retrospective Study with 1- to 12-Year Follow-Up. J Prosthodont. 2020;29(1):3-11 (PMID: 31650669).

10. Gündoğar H, Uzunkaya M, Öğüt S, Sarı F. Effect of peri-implant disease on oral health–related quality of life in geriatric patients. Gerodontology. 2021;38(4):414-21 (PMID: 33977569).

11. Romandini M, Lima C, Pedrinaci I, Araoz A, Costanza Soldini M, Sanz M. Clinical signs, symptoms, perceptions, and impact on quality of life in patients suffering from peri-implant diseases: a university-representative cross-sectional study. Clin Oral Implants Res. 2021;32(1):100-11 (PMID: 33210787).

12. Engfors I, Örtorp A, Jemt T. Fixed implant-supported prostheses in elderly patients: A 5-year retrospective study of 133 edentulous patients older than 79 years. Clin Implant Dent Relat Res. 2004;6(4):190-98 (PMID: 15841579).

13. Müller F. Interventions for edentate elders--what is the evidence? Gerodontology. 2014;31(1):44-51 (PMID: 24446979).

14. Hagiwara Y, Ohyama T, Yasuda H, Seki K, Ikeda T. Dental implant status in elderly individuals requiring domiciliary dental care in Japan. Int J Implant Dent. 2021;7(1):53 (PMID: 33929624).

15. Srinivasan M, Meyer S, Mombelli A, Müller F. Dental implants in the elderly population: a systematic review and meta-analysis. Clin Oral Implants Res. 2017;28(8):920-30 (PMID: 27273468).

16. Renvert S, Persson GR, Pirih FQ, Camargo PM. Peri-implant health, peri-implant mucositis, and peri-implantitis: Case definitions and diagnostic considerations. J Clin Periodontol. 2018;45(20):278-85 (PMID: 29926496).

17. Newton JT, Asimakopoulou K. Managing oral hygiene as a risk factor for periodontal disease: A systematic review of psychological approaches to behaviour change for improved plaque control in periodontal management. J Clin Periodontol. 2015;42 (Suppl 16):S36-S46 (PMID: 25639708).

18. Sharka R, Abed H, Hector M. Oral health-related quality of life and satisfaction of edentulous patients using conventional complete dentures and implant-retained overdentures: An umbrella systematic review. Gerodontology. 2019;36(3):195-204 (PMID: 30875108).

19. Assunção WG, Barão VAR, Delben JA, Gomes ÉA, Tabata LF. A comparison of patient satisfaction between treatment with conventional complete dentures and overdentures in the elderly: A literature review. Gerodontology. 2010;27(2):154-62 (PMID: 19467020).

20. Seki K, Ikeda T, Urata K, Shiratsuchi H, Kamimoto A, Hagiwara Y. Correlations between implant success rate and personality types in the older people: A preliminary case control study. J Dent Sci 2022;17(3):1266-73 (PMID: 35784148).

21. Lee HJ, Kim YK, Park JY, Kim SG, Kim MJ, Yun PY. Short-term clinical retrospective study of implants in geriatric patients older than 70 years. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010;110(4):442-46 (PMID: 20452256).

22. Jemt T, Sundén Pikner S, Gröndahl K. Changes of Marginal Bone Level in Patients with "Progressive Bone Loss" at Brånemark System® Implants: A Radiographic Follow-Up Study over an Average of 9 Years. Clin Implant Dent Relat Res. 2015;17(4):619-28 (PMID: 24172070).

23. Karlsson K, Derks J, Håkansson J, Wennström JL, Petzold M, Berglundh T. Interventions for peri-implantitis and their effects on further bone loss: A retrospective analysis of a registry-based cohort. J Clin Periodontol. 2019;46(8):872-79 (PMID: 31077421).

24. Dreyer H, Grischke J, Tiede C, et al. Epidemiology and risk factors of peri-implantitis: A systematic review. J Periodontal Res. 2018;53(5):657-81 (PMID: 29882313).

25. Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis. J Clin Periodontol. 2018;45(20):246-66 (PMID: 29926484).

26. Kutkut A, Bertoli E, Frazer R, Pinto-Sinai G, Fuentealba Hidalgo R, Studts J. A systematic review of studies comparing conventional complete denture and implant retained overdenture. J Prosthodont Res. 2018;62(1):1-9 (PMID: 28666845).