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Implant Therapy in Aggressive Periodontitis - A Deadly Rehabilitation

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Abstract

Dental implants have revolutionized dentistry by showing a high success rate as a restorative option. This revolution in the research and technology along with long term studies has made the dental implants and an implant supported prosthesis as the first line of treatment with high rate of success when applied for single tooth or multiple teeth replacement. However, in the field of high implant success and predictability, dental implants are considered to be challenging in a small but significant subset of patients with aggressive periodontitis experiencing biological implant failure. When these patient's teeth are replaced by implant supported restoration they represents slight attachment loss and bone loss which is a significant risk factor for implant failure around implants supported prosthesis.

However, there are controversies in the treatment of these patients with the dental implant as various studies have shown only short-term benefits with the use of dental implants in them.

Keywords: Aggressive periodontitis, Risk factor, Biological Implant failures, Peri-implantitis, maintenance program.

Introduction

In the era of modern dentistry, development of an ideal substitute for missing teeth has been one of the enduring aims of dentistry. The lasting benefits that dental implants give are functional resolution (improved mastication, comfort, speech) and esthetic resolution. Not only this, they have also replaced conventional treatment protocols which require huge cutting of the sound tooth structure. The success of dental implants depends on long term implant stability and initial osseointegration i.e. the absence of clinical mobility. However, sometimes implant fails probably due to multifactorial process. Reported predictors for implant success and failure are generally divided into patient-related factors (*e.g.*, general patient health status, smoking habits, quantity and quality of bone, oral hygiene maintenance, etc.), implant characteristics (*e.g.*, dimensions, coating, loading, etc.), implant location, and clinician experience. It is essential to identify a failing implant in time to avoid continuous alveolar bone loss which might complicate the option of replacing the failed implant with a new one as well as impair the aesthetic outcome of the area. This situation arises in compromised host i.e. patient with a history of aggressive periodontitis.

Periodontitis is an inflammatory disease of the tooth supporting structure which may result in tissue destruction. The more severe type is the generalized aggressive periodontitis which is the disease of healthy individuals generally in younger age group with rapid destruction of the alveolar bone around more than one tooth of the permanent dentition. Despite there being a presence of deep pockets and advanced bone loss these individuals lack clinical inflammation.

The deadly infection is restricted to permanent dentition and is affected by many risk factors like and the most common factor is the role of microbes and the immunological response of host towards microbes. The dominant microorganisms which adhere to and grow on the tooth's surfaces are A. actinomycetemcomitans and P. gingivalis[1,2]. Tonetti & Mombelli in 1999 stated that leukotoxin, endotoxins, collagenase, and chemotactic inhibition factor contribute to the disease process by destroying PMN's & Macrophages along with degradation of collagen and inhibition of IgG and IgM[3]. Not only microbes and host response but also the genetic make-up is involved in the pathogenesis of the progression of the disease leading to severe bone loss, attachment loss and finally the tooth is lost [4]

The criteria of success in implant dentistry remains complex. However the word success has been interchanged with the survival of implant. Therefore it is important to differentiate between the survival and the success. Implant success means that implants are not only in the mouth but are functioning and in acceptable condition whereas if the nonfunctional implants require additional treatment they are counted in the survival group[5].

James RA in 1980 presented the scale for clinical evaluation of implant quality which was later on modified by Misch in 1993 to evaluate the prognosis of an implant.[6,7] (TABLE 1)

Implant Therapy in Aggressive Periodontitis : For healthy patient, success rates of some implant systems have been reported to be 99%, even after 15 years follow –up. Therefore a lot of enthusiasm was generated. Over the last three decades, lots of researches were carried out for implant placement and its success by replacing the loss and maintaining the smile in the patients with a history of periodontal disease. Some of them have shown positive results whereas few studies have concluded with additional crestal bone loss after implants were placed in them. Furthermore, the long term prognosis of the teeth may be questionable because of tendency towards relapse of disease.

Mombelli A reported the presence of periodontal pathogens Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis and Prevotella intermedia even after implants were placed at 3 months and 6 months. These pathogens from the periodontal pocket may transmit and colonies in the subgingival area of the implant site resulting in bacterial contamination and a condition known as peri-implantitis[8]. This impression proves that the microorganisms responsible for aggressive periodontitis are similar with that of the peri-implant infection and failing implants. The identification of these patients is essential because prevention is better than cure as the health status of the peri-implant tissues is influenced by health of periodontal tissues.

In 2001, the criteria for success rate of implants with regard to patients with previous history of periodontitis were formulated as absolute immobility of the implant abutment, absence of periimplant osteolytic zones through radiograph and absence of inflammation and pain or parenthesis[9].This made a lot of curiosity among the clinicians and because of them various studies were carried out to analyze the success rate as well as the survival of implants along with detailed description of each parameter i.e. periodontal pocket probing depth, bleeding on probing, marginal bone loss, prevalence of peri-implantitis and implant survival.(TABLE 2)

Periodontal Pocket Probing Depth :Two studies reported deeper pockets around implants than teeth after an observation period of 5 years. A significant difference was reported especially in case of pockets with a depth of 4 mm, with an incidence of 16.9% and 26.6% around teeth and implants, respectively. Although patients undergoing a preventive maintenance program showed better results in terms of periodontal pocket depth, however, the PPD around implants was alsodeeper under such maintenance[10,11]. One long term study (10 years observation period) showed no significant difference between both teeth and implants, with a PPD of 2.02

and 2.78mm respectively[12]. In contrast, another study with the same observation period reported deeper PDD around implants than around teeth (Mengel et al 2007)[13]. In the study by Roccuzzo et al, the periodontal pocket depth was compared between three groups after 10 years observation period. Here, the mean PD was 3.1 ±0.5 in periodontally healthy individuals (PHP), 3.5 ± 0.9 in moderately periodontally compromised patients (PCP) and 3.9 ± 0.7 in severely periodontally-compromised patients. Here, the difference was considered significant between the PHP and severely PCP patients [14].

Bleeding on Probing (BOP): Most of the studies showed bleeding on probing with different percentages. In three studies, implants showed more susceptibility to bleeding on probing after 5 and 10 years, even if periodontal maintenance programs were followed[10,11,12]. Other studies compared peri-implant bleeding on probing in periodontally-compromised subjects with periodontally healthy subjects and reported higher percentages in patients susceptible to periodontitis with a range between 32-40%[8,13,15].

Marginal Bone Loss: The marginal bone loss was measured as the distance from the marginal bone level to the shoulder of the implant. It was observed in most of the studies. Karoussis et al[12] showed higher mean bone loss after observation periods of 10 years between periodontally healthy and periodontally-compromised subjects whereas Mengel et al[13]showed a mean marginal bone loss of 1.3mm after 10 years in patients with generalized aggressive periodontitis. Also, after 10 years of observation period, significantly higher amount of bone loss in periodontally-compromised patients were reported as compared to periodontally healthy patients independent of the implant type used[16].In contrast, the study by Roccuzzo et al reported no significant difference between three groups (PHP, moderately and severely PCP)[14]. But Gianserra et al in 2010 reported the difference was significant in severe periodontitis (2.6mm) compared to non- periodontitis (1.2mm)[17].

The Prevalence of Peri-Implantitis: An inflammatory process caused by anaerobic bacteria affecting the tissues around an implant and loss of supporting bone is known to be peri-implantitis. Leonhardt et al in 1993 stated that a regular maintenance program is essential in the periodontally compromised patients to keep the periodontal and peri-implant tissues healthy[18].

A correlation between periodontitis and prevalence of periimplantitis was reported i.e. the incidence of periimplantitis was also significantly 14 times higher in patients with generalized aggressive periodontitis than periodontally healthy patients[19]. These results were in accordance with the study of Karousiset al[9] which reported 28.6%of peri-implantitis in chronic periodontitis compared to 5.8% in the non-periodontitis group[20]. Also Roccuzzo M et al observed the significant difference in the incidence of peri-implantitis between periodontally healthy (10.7%) and severely periodontally compromised patients (47.2%)[21].

Implant Survival: Survival rate is defined as preservation of osseointegrated implant and not need to be removed at time of observation. One long term study (more than 10 years) reported a survival rate of 97.5% in periodontally-susceptible patients[5]. An almost similar high survival rate of implants was reported in another study after an observation period of 5years[22]. In contrast to that, Mengel et al 2007 reported a lower survival rate of 83.3% in comparison to 100% in the periodontally healthy patients. This was further confirmed by two more studies reporting that implant in generalized aggressive periodontitis had a five time greater risk of failure than periodontally healthy individuals[18,19].However, Karoussis IK et al continued the follow up period to 10 years and reported a statistically significant difference with a survival rate of 96.5% and90.5% for the healthy patients and patient with history of chronic periodontitis, respectively which was in accordance with the survival rate in study by Matarasso et al[16] i.e. a survival rate between 85%-95% in periodontally compromised individuals in dependent of the type of implant used. However in the same study there was a trend towards increased loss of implant in periodontally compromised compared to periodontally healthy subjects.

Roccuzzo et al also found a high incidence of implant loss in both moderate PCP and severe PCP who did not adhere to the Supportive periodontal therapy program[14].

Effect of Smoking: Habit of smoking directly influences the survival of the implant as in periodontally compromised patients there are chances of increased risk of implant failure [8]. In smokers the incidence of peri-implantitis has an odd ratio of 3.6 to 4.6.

A study has shown that the marginal bone loss in smokers was approximately 1mm greater compared to non-smokers, and 0.76mm in smokers and 0.22mm in non-smokers[22], whereas the latest study done by Swierk ot et al described that smoking seems to have no serious influence on peri-implant condition in periodontally treated subjects with implants [19].

Thus, implant treatment in patients with aggressive periodontitis is not contraindicated, provided that adequate infection control and an individualized maintenance program are assured [23,24,25]. Long-term studies on the success of periodontal therapy demonstrate that a well planned and executed periodontal treatment plan is effective in controlling disease progression and preserving the dentition as well as the peri-implant tissue.

An evidence-based approach has been laid down for clinician to identify peri-implant tissue destruction by a protocol known as cumulative interceptive supportive therapy (CIST)[26] which is based on the mucosal condition and the probing depth along the implant sites. It is take-out step by step, starting with mechanical debridement for removal of plaque and calculus at bleeding sites and probing depth less than 4mm.

If the probing depth is between 4mm to 5 mm antiseptic therapy is also followed along with the mechanical debridement.

In the presence of deep pockets with probing depth of more than 6mm, suppuration and signs of bone loss radiographically; antibiotic therapy is implemented along with the mechanical and antiseptic therapy. This result in control of peri-implant infection although this treatment is not sufficient if there is bone loss. So, depending on the extent and severity of the local bone loss, either regenerative or resective measures are to be carried out[27].

In general the instructions for maintenance of periimplant site are similar to those for patients with natural dentition except that we should avoid the use of metal hand instruments and ultrasonic tips for calculus removal and also avoid acidic fluoride and abrasive prophylactic pastes[28].

Table 1: Evaluation of Implant Success

Group	Clinical Conditions	Management
I (optimum health)	• No pain or T.O.P • No mobility • <1.5 mm crestal bone loss • <1mm bone loss in 3 years • No history of exudate • No radiolucency • 0-1bleeding index • After 1year, stable probing depth <4mm	• Normal maintenance
II (satisfactory health)	• No pain or T.O.P • No mobility • 1.5 to 3 mm crestal bone loss • <1mm bone loss in 3 years • Transient history of exudate • No radiolucency • 0-1bleeding index • >4mm probing depth, but stable in last 3year period	• Reduce stress • Shorter intervals between hygiene appointments • Gingivoplasty • Yearly radiographs
III (compromised health)	• No pain or T.O.P • 0-0.5mm horizontal mobility after prosthesis delivery, no vertical mobility • >3 mm bone loss in the first year • >1mm crestal bone loss in 3 years	• Reduce stresses • Drug therapy, Abs, chlorhexidine • Surgical re-entry • Change in prosthesis and / or implants

	• history of exudate in last 3 years • slight radiolucency around crestal portion of implant • 1-3 bleeding index • >5mm probing depth,increase in 3 year period	
IV (clinical failure of the following conditions)	• pain on palpation, or percussion • >0.5mm horizontal mobility after prosthesis delivery • Uncontrolled progressive bone loss • >half bone loss supporting implant • Uncontrolled exudate • Generalized radiolucency • "Sleepers" (implants surgically placed but unable to restored).	• Removal of implant
V (absolute failure)	• Implant surgically removed • Implants exfoliated	• Bone grafts

Table 2: Implant Therapy In Aggressive Periodontitis

References	Type of study with follow up period	Study population and implants placed	Confounding factors	Parameters evolved	Results
Baelum&Ellgard (2004)[64]	Retrospective study with 10 years follow up	108 PCP (201 implants)	Smokers 64%	B.O.P = 70% PD<4mm =24% PD>6mm= 25% BL<1.5mm= 60% BL>3.5mm=14%	Survival rate = 78%.smoking and peri-implantitis significantly associated with increased implant failure rate.
Karoussis et al (2004)[49]	Prospective study with 10year follow up period	89 patients with periodontal disease (179 implants)	ND	mPI mGI mBI mBOP PD CAL	mPI = 0.40% for teeth ; 0.36 %for implants mGI = 0.28% for teeth; mBI = 0.19% mBOP= 30.2% for teeth ;42.2% for implantsPD= 2.02 mm for teeth; 2.78mm for implantsCAL= -2.69mm for teeth; -3.33mm for implants
Rosenberg et al (2004)[65]	Retrospective study with 156 months follow up	151 PCP (519 implants)	Non-smokers	Implant characteristics Bone loss Attachment level	No data reported
Jansson et al (2005)[66]	Retrospective study with 10 years follow up	766 patients treated for PDD (1796 implants)	Non-smoker	Survival rate	97% for maxilla 92% for mandible
Mengel & Flores-de-Jacoby (2005)[67]	Prospective longitudinal study with 3 year follow up	GAgP = 15 patients (77 implants) CP = 12 patients (43 implants) PH = 12 patients(30 implants)	Non- smoker with no systemic disease	Bone loss Peri-implantitis Survival rate	BL= 1.14mm; 0.86mm;0.7mm Peri-implantitis = NR Survival rate = 97.4%; 100%; 100%
Mengel et al (2005) [68]	Prospective study for 3year follow up	HP = 10patients (11implants) GAgp = 10patients (15 implants)	Non-smoker with no systemic disease	Mean bone loss Peri-implantiis Survival rate	Mean bone loss for HP = 1.4mm For GAgP= 1.78mm Peri-implantitis = NR for both groups Survival rate = 100% for HP and 97.4% for GAgP
Roos-Jansaker et al	Prospective study	218 patient (1057		BOP,	B.O.P at implant site = 46.6± 27%.

(2006)[53]	with 9 to 14 years follow up	implants)		SURVIVAL RATE PREVALENCE OF PERI-IMPLANTITIS	Survival rate = 95.7% Prevalence of Peri-implantitis is +++
Mengel et al (2007)[54]	Prospective cohort study with 10year follow up	5 GAgP patients = 36 implants 5 PH patients = 7 implants	No systemic disease Non-smokers	Bone loss Peri-implantitis Survival rate	Bone loss was recorded as 3.37mm for GAgP; and 1.24mm in PH patients. Peri-implantitis was not reported Survival rate is 83.3% for GAgP and 100% for PH.
De Boever et al (2009)[52]	Prospective longitudinal study with <6year follow up	16GAgP patients (59 implants) 68 CP patients (193 implants) 110 PH patients (261 implants)	GAgP patients were also involved in smoking = 4% and systemic disease = 9%	Bone loss Peri implantitis Survival rate	Bone loss in GAgP, CP and PH are 0.17mm, 0.09mm and 0.07mm Peri-implantitis was 12.7%. Survival rate was 84.8%; 96% and 97%.
Matarasso et al (2010)[55]	Retrospective study for 10 year follow up	40 patients PCP and 40 PHP (80 implants)	Non-smokers	FMPS FMBS MEAN BONE LOSS IMPLANTS WITH BONE LOSS >3MM	High marginal bone loss rate around implants placed in PCP as compared with PHP. The survival rate are PCP=92.5% PHP=95%
Rocuzzo et al (2010)[50]	Prospective cohort study with 10year follow up	PHP (28), moderately PCP (37) and severely PCP (36)} with 246 implants placed		Mean plaque score FMPS BOP FMBS PD BL Implant survival rate	Patients with history of periodontitis presented a lower survival rate and higher number of sites with peri-implant bone loss. The survival rates are PHP= 96.6% Moderate PCP= 92.8% Severe PCP= 90%
Aglietta et al (2011)[69]	Retrospective study for 10 years	PHP = 20 PCP = 20 (40 implants)	Smokers consuming >10 cigarette/day at the beginning and at the 10year follow up	FMBS BL Survival rates	Implants placed in patients with the history of smoking and history of treated periodontitis yield lower survival rate and higher marginal bone loss.
Pjetursson et al (2012)[70]	Retrospective study for 7.9 year follow up	172 patients(161 implants)	smoker	PD CAL BOP FMBS SURVIVAL RATE	Significant risk for development of peri-implantitis and implant loss. The survival rate is 95.8%
Lee et al (2012)[51]	Retrospective study for 8 year follow up	PCP = 30 patients(56 implants) PHP = 30 patients (61implants)		Peri-implantitis PD around implants BOP BONE LOSS FMPS FMBS	PD> 6mm have high risk for peri-implantitis. The prevalence for it was 26.1%

Rocuzzo et al (2012)[55]	Prospective cohort study with 10year follow up	PHP (28), moderately PCP (37) and severely PCP (36) (246 implants)		Mean plaque score FMPS BOP FMBS PD BL Implant survival rate	Patients with history of periodontitis presented a lower survival rate and higher number of sites with peri-implant bone loss. The survival rates are PHP= 96.6% Moderate PCP= 92.8% Severe PCP= 90%
Swierkot et al (2012)[58]	Prospective cohort study with 5-16 year follow up	35 patients of GAgp (149 implants) 18 patients of PH(30 implants)	GAgp patients Non smokers = 58 Former= 28 Current=63 Whereas in PH patients Non smoker = 19 Former = 5 Current = 6	Bone loss Peri-implantitis Survival rate	Bone loss was not reported in both the groups In GAgP peri-implantitis was reported to be 26% and in PH 10 %. The survival rates were 96% and 100% respectively .
Rocuzzo et al (2013) [71]	Prospective cohort study with 10year follow up	PHP= 32; moderately PCP= 46 And severe = 45. (252 implants)		Plaque score FMBS PD BL FMPS BOP	The survival rate are PHP = 100% Moderately PCP= 92.8% and severe PCP = 90%

Abbreviations: PCP = Periodontally compromised patients, PHP = Periodontally healthy patients, B.O.P = Bleeding on probing, PD = Probing depth, BL= Bone loss, mPI = Mean plaque index,mGI = Mean gingival index, mBL= Mean bone loss, mBOP = mean bleeding on probing, CAL = Clinical attachment loss, GAgP = generalized aggressive periodontitis, CP = chronic periodontitis,FMPS = Full mouth plaque score, FMBS = Full mouth bleeding score, ND = No data.

Conclusion

The treatments which can be conducted in a standard dental care practice have made implant therapy an integral part of the modern dentistry. This revolution in the field of dentistry has hold future development of the society. But the periodontal disease is a potential risk factor for causing peri-implantitis which may results in failure of implant therapy. However dearth of scientific evidence based literature does not allow for drawing clear conclusions for placing implants in periodontally compromised host.

Therefore it seems prudent to screen all the individuals for periodontal disease before making any decision for implant placement.

References

1. Kononen E and Muller HP. Microbiology of aggressive periodontitis. P2000 2014;65:46-78.
2. Teughels W, Dhondt R et al. Treatment of aggressive periodontitis. P 2000 2014;65:107-133.
3. Tonnetti MS, Mombelli A. Early- Onset Periodontitis. Ann Periodontol 1999;4(1):39-53
4. Alexandre R. V and Albandar J M. Role of genetic factors in the pathogenesis of aggressive periodontitis. P 2000 2014;65:92-106.
5. NegamSAM . Implant Success versus Implant Survival. Dentistry 2016; 6:359.
6. Misch CE. Implant Dentistry. 2nd ed. St. Louis: Mosby; 1999.

7. David A. Puleo and Mark V. Thomas. Implant Surfaces. Dent Clin N Am2006;50:323-38
8. De Boever AL, Quirynen M, Coucke W, Boever JA and Theuniers G. Clinical and radiographic study of implant treatment outcome in periodontally susceptible and non-susceptible patients: a prospective long term study. Clin Oral Implants Res 2009;20:1341-50.
9. Mengel R, Schroder T and Flores-de-Jacoby L. Osseointegrated Implants in Patients Treated for Generalized Chronic Periodontitis and Generalized Aggressive Periodontitis:3- and 5-Year Results of Prospective Long-Term Study. J Periodontol 2001;72:977-89.
10. Agerbaek MR, Lang NP, Persson GR. Comparisons of bacterial patterns presents at implant and tooth sites in subjects on supportive periodontal therapy. I. Impact of clinical variables, gender and smoking. Clin Oral Implants Res 2006;17:18-24.
11. Costa FO, Takenaka-Martinez S, Cota LOM, Ferreira SD, Silva GLM, Costa JE.Peri-implant disease in subjects with and without preventive maintenance: a 5-year follow-up. J Clin Periodontol 2012;39:173-181.
12. Karoussis IK, Muller S, Salvi GE, Heitz- Mayfield LJ, Bragger U and Lang NP. Association between periodontal and peri-implant conditions: a 10 year prospective study. Clin Oral Implants Res 2004;15:1-7
13. Mengel R, Schroder T and Flores-de- jacoby L. Osseointegrated implants in patients treated for generalized aggressive periodontitis:10 year results of a prospective, long term cohort study. J Periodontol 2007;78:2229-37
14. Roccuzzo M, De Angelis N, Bonino L andAglietta M. Ten year results of a three-arm prospective cohort study on implants in periodontally compromised patients. Part1: implant loss and radiographic bone loss. Clin Oral Implants Res 2010;21:490-96.
15. Roos-JansakerAM, Lindahl C, Renvert H, Renvert S. Nine- to fourteen-year follow-up of implant treatment. Part I: implant loss and associations to various factors. JClin Periodontol 2006;33:283-89
16. Mataraasso S, Rasperini G, IorioSiciliano V, Salvi GE, Lang NP and Aglietta M. A 10 year retrospective analysis of radiographic bone level changes of implants supporting single –unit crowns in periodontally compromised vs. periodontally healthy patients. Clin Oral Implants Res 2010;21:898-903.
17. Gianserra R, Cavalcanti R, Oreglia F, Manfredonia MF, Esposito M. Outcome of dental implants in patients with and without a history of periodontitis: a 5-yearpragmatic multicentre retrospective cohort study of 1727 patients. Eur J Oral Implantol 2010;3:307-14.
18. Leonhardt A, Adolfsson B, Lekholm U, Wikstrom M and Dahlen G. A longitudinal microbiological study on osseointegrated titanium implant in partially edentulous patients. Clin Oral Impl Res 1993;4:113-120.
19. Swierkot K., Lottholz P., and Mengel R. Mucositis, peri-implantitis, implant success, and survival of implants in patients with treated generalized aggressive periodontitis:3-16 year results of a prospective long term cohort study. J Periodontol 2012;83:1213-25.
20. Karoussis IK, Salvi GE, Heitz-Mayfield LJ, Bragger U, Hammerle CH, Lang NP. Long-term implant prognosis in patients with and without a history of chronic periodontitis: a 10-year prospective cohort study of the ITI Dental Implant System. Clin Oral Implants Res 2003;14:329-39.

21. Roccuzzo M, Bonino F, Aglietta M andDalmasso P. Ten year results of a three-arm prospective cohort study on implants in periodontally compromised patients. Part1: implant loss and radiographic bone loss. Clin Oral Implants Res 2012;23:389-95.
22. Wennstrom JL, Ekestubbe A, Grondahl K, Karlsson S, Lindhe J. Oral rehabilitation with implant-supported fixed partial dentures in periodontitis-susceptible subjects. A 5-year prospective study. J Clin Periodontol 2004;31:713-24.
23. Malmstrom HS, Fritz ME, Timmis DP and Van Dyke TE. Osseointegrated implant treatment of a patient with rapidly progressive periodontitis. A case report. J Periodontol 1990;61:300-4.
24. Mengel R, Schroder T and Flores – de – Jacoby L. Osseointegrated implants in patients treated for generalized chronic periodontitis and generalized aggressive periodontitis: 3 - and 5- year results of a prospective longer term study. J Periodontol 2001;72:977-89.
25. Yalchin S, Yalchin F, Gunay Y, Bellaz B, Onal S andFiratli E. Treatment of Aggressive Periodontitis by Osseointegrated Dental Implants. A Case Report. J Periodontol. 2001;72:411-16.
26. Lang NP., Wilson TG. andCorbet EF. Biological complications with dental implants: their prevention, diagnosis and treatment. Clin Oral Impl Res 2000:11 (Suppl.): 146-155.
27. Lindhe J, and Liljenberg B. Treatment of localized juvenile periodontitis. Results after 5 years. J Periodontol 1984:11:399-410.
28. Newman, Michael G, Henry H. Takei, and Fermin A. Carranza. Carranza's Clinical Periodontology. Philadelphia: W.B. Saunders Co, 2002.
29. Baelum V and Ellegaard B. Implant survival in periodontally compromised patients. J Periodontol 2004;75: 1404-12.
30. Rosenberg ES , Cho SC, Elian N, Jalbout Z.N, Froum S., and Evian CI. A comparison of characteristics of implant failure and survival in periodontally compromised and periodontally healthy patients: a clinical report. Int J Oral Maxillofac Implants 2004;19:873-79.
31. Jansson H, Hamberg K, Bruyn H, and BratthallG. Clinical consequences of IL-1 genotype on early implant failures in patients under periodontalmaintenance. Clin Implant Dent Relat Res 2005; 7: 51–9.
32. Mengel R and Flores-de- jacoby L. Implants in patients treated for generalized aggressive and chronic periodontitis: A 3 year prospective longitudinal study. J Periodontol 2005;76:534-43.
33. Mengel R and Flores-de- jacoby L. Implants in regenerated bone in patients treated for generalized aggressive periodontitis: a prospective longitudinal study. Int J Periodontics Restorative Dent 2005;25:331-41.
34. Aglietta M, Siciliano VI, Rasperini G, Cafiero C, Lang NP and Salvi GE. A 10-year retrospective analysis of marginal bone-level changes around implants in periodontally healthy and periodontally compromised tobacco smokers. Clin Oral Implants Res 2011;22:47-53.
35. Pjetursson BE, Helbling C and Weber HP et al. Peri-implantitis susceptibility as it relates to periodontal therapy and supportive care. Clin Oral Implants Res 2012;23:888-94.
36. Roccuzzo M, Bonino L, Dalmasso P andAglieta M. Long term results of a three-arm prospective cohort study on implants in periodontally compromised

patients: 10 year data around sandblasted acid etched (SLA) surface.Clin Oral Implants Res 2013;25:1105-12.

37. Cho-Yan Lee J, Mattheos N, Nixon KC, Ivanovski S. Residual periodontalpockets are a risk indicator for peri-implantitis in patients treated for periodontitis. Clin Oral Implants Res 2012;23:325-33.