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## CORRELATION OF THE PERIODONTAL STATUS OF THE ADJACENT TEETH TO IMPLANTS AND PERI-IMPLANTITIS

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**Abstract:** There is a strong similarity between chronic periodontitis and peri-implantitis. Both periodontitis and peri-implantitis are caused by a bacterial infection by microorganisms located in the dental biofilms. Also these two conditions show similar clinical features such as soft tissue inflammation and alveolar bone defects on the teeth or dental implants. Peri-implantitis is defined as infection around the body or the apex of the implant followed by alveolar bone loss around the implant. This inflammatory process if not treated could lead to the complete loss of the implant-supported prosthodontic restoration. These clinical features are similar for the chronic periodontitis. Clinically, the inflammatory process in peri-implantitis and in chronic periodontitis can be presented as bleeding on probing, deepened periodontal pockets and periodontal suppuration. But there is one importance difference- the inflammation of the peri-implant tissues develops faster than that of the periodontal tissue. It is caused because the attachment between the implant body and the gingiva is weaker than the tissue connections of the gingiva to the natural teeth. Chronic periodontitis determines the longevity of dental implants. It has been observed that in patients with periodontitis, there are more chances of developing of peri-implantitis. Patients need to be aware that if satisfactory periodontal status is not achieved, dental implants and their longevity may be compromised. And also in patients with peri-implantitis there is bigger chance for higher incidence and prevalence of chronic periodontitis. The main aim of this research was to determine the correlation between peri-implantitis and periodontitis in adjacent teeth to implants. Material and method: This study was conducted on 23 patients with 29 dental implants placed in the period from January 2015 to December 2018. In this retrospective study, all implants were placed by one oral surgeon. Patients were divided into two groups- Group I (12 dental implants) with peri-implantitis and Group II (17 dental implant) without peri- implantitis. On every dental implant, probing depth was measured to determine the presence of peri-implantitis. Except around all 29 implant sites, 29 adjacent teeth and 29 contralateral teeth were examined. On every tooth probing depth (PD) and clinical attachment loss (CAL) were measured. **Results:** The results showed that there is not significant difference among the periodontal measurements on the adjacent and contra lateral teeth. Probing depth was  $4.38 \pm 0.37$  in group I and  $2.99 \pm 0.41$  in group II around adjacent teeth (significant  $P > 0.0001$ ). Probing depth around contra lateral teeth was significant ( $P > 0.0001$ ) in group I ( $4.14 \pm 0.44$ ) and group II ( $3.35 \pm 0.34$ ). Clinical attachment loss in group I and II on adjacent and contra lateral teeth were not significant ( $p = 0.97$  and  $p = 0.28$ ). **Conclusion:** The presence of peri-implantitis, the tooth location especially if it is adjacent to the dental implants and the examining site are significantly associated with the periodontal measurements of the remaining teeth. But risk factors for periodontal diseases need to be evaluated, especially when implants are placed. Therefore, maintaining a satisfactory oral hygiene around implants is extremely important for their longevity. This is especially true in the period after implant placement, in the stage of maintaining of achieved results and of course in the assessment of the success of the implant therapy itself.

**Keywords:** chronic periodontitis, peri-implantitis, clinical attachment loss, periodontal depth

### 1. INTRODUCTION

Chronic periodontitis and peri-implantitis have a lot of similarity. Both periodontitis and peri-implantitis are inflammatory process caused by a bacterial infection from microorganisms located in the dental biofilms (dental plaque). Also these two conditions show similar clinical features such as soft tissue inflammation and alveolar bone defects around the teeth or dental implants.

Pathological changes of peri-implant tissues (tissues around dental implants) are placed in one big general category of peri-implant diseases. Inflammatory changes of the soft tissues surrounding an implant are diagnosed as peri-mucositis. Progressive forms of this inflammatory processes followed by bone loss are diagnosed as peri-implantitis. (Schwarz et al, 2018)

Peri-implantitis is defined as infection around the body or the apex of the implant followed by alveolar bone loss around the implant. This inflammatory process if not treated could lead to the complete loss of the implant-supported prosthodontic restoration. (Prathapachandran & Suresh, 2012) These clinical features are similar for the

chronic periodontitis. Clinically, the inflammatory process in peri-implantitis and in chronic periodontitis can be presented as bleeding on probing, deepened periodontal pockets and periodontal suppuration. (Heitz-Mayfield, & Lang, 2010)

Bleeding on probing occurs rear in healthy tissues around implants. (Eickholz , 2004) The sulcus around an implant is lined by sulcular epithelium that is continuous apically with junctional epithelium similar like around nature teeth. (Klokkevold et al, 2002)

But there is one importance difference- the inflammation of the peri-implant tissues develops faster than that of the periodontal tissue. It is caused because the attachment between the implant body and the gingiva is weaker than the tissue connections of the gingiva to the natural teeth. (Ata-Ali et al, 2015 ) This plaque-associated soft tissue inflammation around dental implants may have more serious implications than marginal inflammation around teeth with periodontal ligament. (Casado et al, 2013)

According to Dalago et al (2017) there is an increased risk of 2.2 times for periodontal disease among patients with peri-implantitis. Periodontal disease on adjacent teeth at the time of implantation, history of tooth loss due to periodontitis and a mean values plaque index of 1.6 or more according to Kumar et al (2018) are associated with significantly increased risk for peri-implantitis.

Subgingival bacterial flora on clinically inflamed implant sites is different to that seen around one healthy implant. But bacterial flora from dental plaque in chronic periodontitis and peri-implantitis has great similarities. This bacterial flora from the peri-implant tissues can be easily transferred on the periodontal tissues on the adjacent teeth nearest to the dental implant. ( Shahabouee et al, 2012)

Chronic periodontitis is one of the most common diseases in the human population. The lack of rich clinical symptomatology in chronic periodontitis is the reason why this disease is often ignored by patients until the mobility of the teeth lead to inability to chew food. Because of this, chronic periodontitis often leads to tooth loss, dental disability, and need for prosthetic devices, which can be seen to be of great socio-medical significance. Also chronic periodontitis influence of dental implant therapy. (Renvert & Persson, 2009)

Chronic periodontitis determines the longevity of dental implants. It has been observed that in patients with periodontitis, there are more chances of peri-implantitis. Patients need to be aware that if satisfactory periodontal status is not achieved, dental implants and their longevity may be compromised. (Kandasamy et al, 2018) And also in patients with peri-implantitis there is bigger chance for higher incidence and prevalence of chronic periodontitis. (Poli et, 2016)

The main aim of this research was to determine the correlation between peri-implantitis and periodontitis in adjacent teeth to dental implants.

## 2. MATERIAL AND METHOD

This retrospective study was conducted on 23 patients from both genders with 29 dental implants placed in the period from January 2015 to December 2018. This study was conducted in one private dental office in Stip, Republic of N. Macedonia and all implants were placed by one oral surgeon.

From the total number of subjects, 12 from the subjects were male and 11 were female. The average age of the subjects was  $49.07 \pm 11.59$  years.

Inclusion criteria were: 1) had at least one implant in the posterior region, 2) had received implant at least one year ago, 3) there were at least one adjacent natural tooth and one contralateral tooth around the dental implant, 4) patients with evidence of periodontitis (presence of bleeding on probing) , 5) had full mouth periodontal charting data (including probing depth, gingival recession, and clinical attachment loss) and 6) had full mouth treatment of periodontal disease before the implant placement. The exclusion criteria were: 1) had history of periodontal surgical treatment, 2) had third molar, 3) patients with systemic disorders and diseases or patients that use medicaments that can cause gingival enlargements and 4) smoking and tobacco users.

All subjects were divided into two groups- Group I (total number of 12 dental implants) with peri-implantitis and Group II (total number of 17 dental implants) without peri- implantitis. On every placed dental implant, clinically probing depth was measured to determine the presence of peri-implantitis. Peri-implantitis was diagnosed when an implant there was presented radiographic bone loss of  $>3$  mm following implant integration, with the probing pocket depth (PD) more than 3 mm, and presence of bleeding on probing or suppuration around the dental implant.

Except around all 29 implant sites, 29 adjacent teeth and 29 contralateral teeth were clinically examined. On every tooth probing depth (PD) and clinical attachment loss (CAL) were measured. The probing depth and the clinical attachment loss were measured at six sites- mediobuccal, mesiobuccal, distobuccal, mediolingual, mesiolingual and distolingual around every dental implant and every tooth adjacent to implant and on every contralateral teeth, with using a manual probe.

Probing depth was measured as the probing tip was inserted into the gingival sulcus parallel to the long axis of the tooth until slight resistance was met. Clinical attachment loss was measured from cement-enamel junction (CEJ) at each examination site until slight resistance was met.

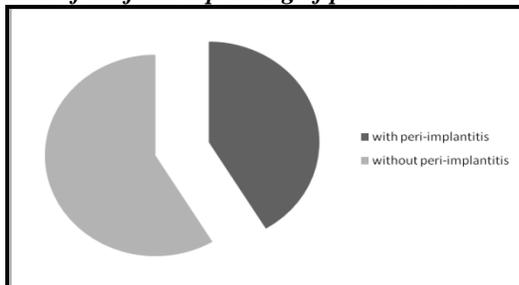
All statistical analysis was performed by SPSS for Windows (version 18.0, SPSS) and the level of statistical significance was set at  $p < 0.05$ .

The results are presented with graphs and tables.

### 3. RESULTS

From all 29 placed implants, 12 showed signs of peri-implantitis and the other 17 implants do not have any changes that can be diagnosed as peri-implantitis.(Fig. No.1)

**Fig. No. 1. Classification of subjects depending of presence or absence of peri-implantitis**



The mean value for periodontal depth for implants ( $4.11 \pm 1.64$  mm) was significantly different from that for adjacent teeth ( $3.68 \pm 0.55$  mm), but was not significantly different from that for contralateral teeth ( $3.57 \pm 0.76$  mm) ( $p = 0.53$ ). There were statistical significance observed between clinical attachment loss for adjacent teeth ( $3.96 \pm 0.58$  mm) and contralateral teeth ( $3.93 \pm 0.64$  mm) for  $p = 0.852$ .

**Table No. 1. Assessment of periodontal & peri- implant status**

Periodontal parameter	Implant	Adjacent teeth	Contralateral teeth
Probing depth	$4.11 \pm 1.64$ mm	$3.68 \pm 0.55$ mm	$3.57 \pm 0.76$ mm
Clinical attachment loss		$3.96 \pm 0.58$ mm	$3.93 \pm 0.64$ mm

After the clinical examination the mean values for periodontal depth around implants was  $4.58 \pm 0.85$  in group I and  $3.17 \pm 0.36$  in group II a which is considered to be extremely statistically significant ( $P < 0.0001$ ).

Clinical attachment loss measured in this study was highly significant ( $P < 0.001$ ) among group I ( $4.57 \pm 0.28$ ) and group II ( $3.48 \pm 0.37$ ) in adjacent teeth. Probing depth was  $4.38 \pm 0.37$  in group I and  $2.99 \pm 0.41$  in group II around adjacent teeth which showed significant difference ( $P < 0.0001$ ). (Table No.2)

Clinical attachment loss measured was highly significant ( $P = 0.0009$ ) among group I ( $4.35 \pm 0.43$ ) and group II ( $3.68 \pm 0.51$ ) in contralateral teeth. Probing depth was also showed significant difference ( $P < 0.0001$ ) because the measured values were  $4.14 \pm 0.44$  in group I and  $3.35 \pm 0.34$  in group II around contralateral teeth. (Table No. 2)

**Table No. 2. Periodontal status around adjacent and contralateral teeth in both groups**

Periodontal parameter	Adjacent teeth		Contralateral teeth	
	With peri-implantitis	Without peri-implantitis	With peri-implantitis	Without peri-implantitis
Probing depth	$4.38 \pm 0.37$ mm	$2.99 \pm 0.41$ mm	$4.14 \pm 0.44$ mm	$3.35 \pm 0.34$ mm
Clinical attachment loss	$4.57 \pm 0.28$ mm	$3.48 \pm 0.37$ mm	$4.35 \pm 0.43$ mm	$3.68 \pm 0.51$ mm

The results also showed that there is significant difference between periodontal depth among the adjacent teeth and contralateral teeth in patients with peri-implantitis ( $p = 0.028$ ). But the other clinical parameter, clinical attachment loss does not show significant difference ( $p = 0.97$ ) between adjacent and contralateral teeth in patients with peri-implantitis.

#### 4. DISCUSSION

The primary aim of this study was to determine the correlation of the periodontal status of the adjacent teeth to implants with peri-implantitis. Comparing the data of this study with other studies was very complex due to the existence of numerous variations in context of diagnostic methodology and criteria between different studies. A special problem was the lack of numerous published data regarding this issue. This disables the possibility of comparison with our literary data.

In the contemporary dental science literature there are a small amount of articles that have shown moderate evidence that periodontitis is a risk factor for peri-implantitis and that patients with periodontitis have higher implant-bone loss. (Lee, 2014) This is a reason more for why we have done this research, to note if there is a correlation between the presence of peri-implantitis and periodontal status of adjacent teeth to dental implants.

There is strong evidence that dental plaque not only leads to gingivitis and periodontitis, but can also cause the development of peri-implantitis. Thus, personal oral hygiene must begin at the time of dental implant placement and should include the use of various activities for removal of dental plaque from the peri-implant region before, during, and after implant placement. (Gulati et al, 2014)

It must be noted that there is a strong evidence suggests that periodontitis is a risk factor for implant loss. In general, the failure of implant therapy is quite small, and the modern literature suggests that there are no absolute contraindications to implant placement among patients. Conditions that have been found to be correlated with an increased risk of implant failure, like chronic periodontitis should be considered when planning treatment. (Liddelow & Klineberg, 2011)

According to Botero et al (2005) bleeding on probing and signs of inflammation accompanied by increased probing depth (5.2 mm) are constantly present in cases of peri-implantitis, but are absent in cases of stable implants. These results are similar to our research, when peri-implantitis was diagnosed.

In our study we found that clinical attachment loss was higher in patients with peri-implantitis than those without it. These findings were found for the two groups of teeth, adjacent and contralateral. Thus, it may be suggested that incidence for periodontitis is bigger in patients with peri-implant diseases than those with healthy dental implants. Also, according to our results, it may be suggested that risk of peri-implantitis is more in patient with periodontal diseases than those with healthy periodontium. Probing depth and clinical attachment loss in our study were significantly higher in adjacent teeth group I as compared to group II. Similarly, these two periodontal parameters were higher in adjacent teeth group I as compared to group II. These findings are similar with those from Achanur et al (2020) and Sung et al (2018)

Recognizing the potential risk factors for implant therapy can help reduce the frequency of failure and prevent earlier loss of the implant. With regard to patients with periodontitis, a very important element for the longevity of implants is the correct and precisely defined maintenance phase of therapy. It can be noticed that large differences were observed in patients who came for regular visits to the dentist in the maintenance phase. (Todescan, 2012) Establishing a regulated maintenance protocol after the active phase of periodontal treatment is essential to minimize the risk of marginal alveolar bone loss in implants placed in patients with present periodontal disease. (Rosing et al, 2019)

At the end, we must notice that there is limitation of the study, primarily because there was smaller sample size in particular geographic area. Further long-term study on larger sample size with inclusion of various other factors is needed.

#### 5. CONCLUSION

The presence of peri-implantitis, the tooth location especially if it is adjacent to the dental implants and the examining site are significantly associated with the periodontal measurements of the remaining teeth. But, periodontitis has negative effect on implant success. So it must be noted that teeth adjacent to dental implant plays an important role in deciding the success or failure of implant. Maintenance of periodontal health has high importance for successful implant therapy.

#### REFERENCIES

- Achanur, M., Aldhuwayhi, S., Parihar, A. S., Bhardwaj, A., Das, R., & Anad, K. S. (2020). Assessment of correlation of periodontitis in teeth adjacent to implant and peri- implantitis. *Journal of family medicine and primary care*, 9(1), 243–246.
- Ata-Ali, J., Flichy-Fernández, A. J., Alegre-Domingo, T., Ata-Ali, F., Palacio, J., & Peñarrocha-Diago, M. (2015). Clinical, microbiological, and immunological aspects of healthy versus peri-implantitis tissue in full arch reconstruction patients: a prospective cross-sectional study. *BMC oral health*, 15, 43.

- Botero, J.E., González, A.M., Mercado, R.A., Olave, G., & Contreras, A. (2005), Subgingival Microbiota in Peri-Implant Mucosa Lesions and Adjacent Teeth in Partially Edentulous Patients. *Journal of Periodontology*, 76: 1490-1495.
- Casado, P.L., Pereira, M.C., Duarte, M.L., & Granjeiro, J.M. (2013). History of Chronic Periodontitis Is a High Risk Indicator for Peri-Implant Disease. *Brazilian Dental Journal*, 24(2), 136-141.
- Dalago, HR., Schuldt Filho, G., Rodrigues, MAP., Renvert, S., & Bianchini, MA. Risk Indicators for Peri-implantitis. A cross-sectional study with 916 implants. *Clin. Oral Impl. Res.* 28, 2017, 144– 150
- Eickholz P. (2004). *Clinical Periodontal Diagnosis: Probing Pocket Depth, Vertical Attachment Level and Bleeding on Probing*. *Period.* 1(1): 75-80
- Gulati, M., Govila, V., Anand, V., & Anand, B. (2014). Implant Maintenance: A Clinical Update. *International scholarly research notices*, 2014, 908534.
- Heitz-Mayfield, L.J.A., & Lang, N.P. (2010). Comparative biology of chronic and aggressive periodontitis vs. peri-implantitis. *Periodontology* 2000, 53: 167-181.
- Kandasamy, B., Samson, E. P., Yaqoob, A., Pandey, P., Deenadayalan, S., & Das, I. (2018). Evaluation of Clinical Parameters in Implant Maintenance Phase for Prevention of Peri-implantitis. *Journal of International Society of Preventive & Community Dentistry*, 8(4), 361–364.
- Klokkevold, PR., Newman, MG., Takei, H., Carranza, FA., Carranza, F., & Takei, H. (2002). *Carranza's Clinical Periodontology*, 9e, WB Saunders Co:859-864
- Kumar, PS., Dabdoub, SM., Hegde, R., Ranganathan, N., & Mariotti, A. (2018) Site-level risk predictors of peri-implantitis: A retrospective analysis. *J Clin Periodontol*, 45: 597– 604.
- Lee, D. (2014) Periodontitis and dental implant loss. *Evid Based Dent*, 15, 59–60.
- Liddelow, G. & Klineberg, I. (2011). Patient-related risk factors for implant therapy. A critique of pertinent literature. *Australian Dental Journal*, 56: 417-426.
- Poli, P. P., Beretta, M., Grossi, G. B., & Maiorana, C. (2016). Risk indicators related to peri-implant disease: an observational retrospective cohort study. *Journal of periodontal & implant science*, 46(4), 266–276.
- Prathapachandran, J., & Suresh, N. (2012). Management of peri-implantitis. *Dental research journal*, 9(5), 516–521.
- Renvert, S., & Persson, G.R. (2009). Periodontitis as a potential risk factor for peri-implantitis. *Journal of Clinical Periodontology*, 36: 9-14.
- Rosing, CK., Fiorini, T., Haas, AN., Muniz, FWMG., Oppermann, RV., & Susin, C. (2019). The impact of maintenance on peri-implant health. *Brazilian Oral Research*, 33(Suppl. 1), e074. Epub September 30, 2019.
- Schwarz, F., Derks, J., Monje, A., & Wang, H-L. (2018) Peri-implantitis. *J Periodontol.* 89( Suppl 1): S267– S290.
- Shahabouee, M., Rismanchian, M., Yaghini, J., Babashahi, A., Badrian, H., & Goroohi, H. (2012). Microflora around teeth and dental implants. *Dental research journal*, 9(2), 215–220.
- Sung, CE., Chiang, CY., Chiu, HC., Shieh, YS., Lin, FG., & Fu, E.(2018) Periodontal status of tooth adjacent to implant with peri-implantitis. *J Dent.* 70:104-109.
- Todescan, S., Lavigne, S., & Kelekis-Cholakakis, A. (2012). Guidance for the maintenance care of dental implants: clinical review. *J Can Dent Assoc*, 78(1), 107.