Online ISSN: 2581-3935
Print ISSN: 2589-7837

International Journal of Medical Science and Diagnosis Research (IJMSDR)

Available Online at www.ijmsdr.com

Volume 2, Issue 1; January-February: 2018; Page No. 07-11

An Evaluation of Sterilization and Structural Integrity of Enamel of Diabetes Teeth

Dr. John Harry Bravado

Department of Dental Surgery, Imperial College Dental Surgery, South Kensington, London, U.K.

ABSTRACT:

Diabetes mellitus (DM) and periodontitis are common chronic diseases in adults globally [1]. These diseases are thought to be associated biologically. A number of studies have proposed the mechanisms to explain their relationship including microvascular diseases, changes in components of gingival crevicular fluid, changes in collagen metabolism, an altered host response, altered subgingival flora, genetic predisposition and nonenzymatic glycation [2].

Keywords: Micro, Vascular, Diseases, Pathogenic organism

INTRODUCTION

Although there is extensive knowledge about the pathways through which diabetes affects periodontal status, less is known about the impact of periodontal diseases on the diabetes:

- An increased thickness of the gingival capillaries is well-documented in DM. This impairs the oxygen diffusion and nutrient provision and thereby alters the normal periodontal tissue homeostasis [3,4,5].
- Increased collagen breakdown through stimulation of collagenase activity has been observed in the periodontium in DM. Besides, sustained hyperglycemia causes alteration in collagen metabolism through increased cross-linking, which subsequently influence the healing of periodontium to the microbial challenge [6].
- Multiple mechanisms are involved in regulation of insulin sensitivity and resistance, including genetic factors, environmental stresses, and inflammatory conditions. Elevated levels of several proinflammatory cytokines (TNF-α, IL-6) are seen in periodontitis [7].

Materials & Methods

The present study was a prospective, randomized, parallel arm, double centered clinical trial, which was carried out in the Department of Dental Surgery, Imperial College Dental Surgery, South Kensington, London, U.K. The selected subjects were of type 2 DM with periodontitis (n = 51). The subjects were selected on the basis of the following criteria.

A. Inclusion criteria

- subjects with type 2 DM, without major diabetic complications
- diabetics with moderate to severe periodontitis (30% or more of the teeth examined having ≥ 4 mm clinical attachment loss)
- subjects ≥ 30 years of age regardless of sexes
- subjects with no evidence of other oral and systemic diseases
- subjects under treatment of an endocrinologist

B. Exclusion criteria:

- subjects with uncontrolled DM
- subjects who have undergone periodontal treatment during last 6 months
- subjects administered antibiotic during last 3 months
- subjects with < 20 natural teeth
- subjects allergic to tetracycline and its derivatives

Subjects were explained the entire procedure in details and were included in the study with their consent.

Thorough medical history along with the diabetes record of the subjects was obtained in details. The concerned endocrinologist was well informed

Corresponding author: Dr. John Harry Bravado

regarding the study design. No change in the medication or diet was made for the subjects. None of the subjects received any additional guidance regarding the control of their diabetic status.

The subjects in Group A were received oral hygiene instructions and full mouth SRP, while the subjects in Group B received Doxycycline (Moraceae), (total dose 1600 mg in equally divided sixteen doses, start as 100 mg BD followed by OD for 14 days) [18] in addition to the same therapy as that of group A. The group C (control) received no treatment, even the oral hygiene instructions also.

All the periodontal and metabolic parameters were recorded on day 0 and 90, which were then analyzed statistically using SPSS version 15 (IBM, Chicago, USA). Paired 't' test was used to compare the various parameters on day 0 and 90 within the same group, while Student's unpaired 't' (Independent sample 't') test was used to compare the parameters in between two groups. p value less than 0.05 was considered as statistically significant.

Results & Observations

Out of one thousand subjects screened, eighty (80) subjects were selected for the study. This difference was found to be statistically highly significant ($p < 0.01$). Similarly, the mean difference in plaque index in group B between day 90 and 0 was 1.33 (53.20%) and was statistically very highly significant ($p < 0.001$). On the other hand, the plaque index in group C was found to be increased by 0.06 (2.46%) from day 0 to 90, though not significant statistically ($p > 0.05$).

The gingival index in group A reduces by 45.0% on day 90 compared to day 0, which was found to be statistically very highly significant ($p < 0.001$). Similarly, the reduction in gingival index in group B between day 90 and 0 was 46.08% and statistically very highly significant ($p < 0.001$). The mean probing pocket depth on day 0 was 3.08 ± 0.30 in group A, which reduces by 24.67% on day 90 to 2.32 ± 0.28. This difference was found to be statistically very highly significant ($p < 0.001$). Similarly, the mean difference in probing pocket depth in group B between day 90 and 0 was 1.01 (30.51%) and was statistically very highly significant ($p < 0.001$). On the other hand, the probing pocket depth in group C was found to be increased by 0.10 from day 0 to 90 (2.53%), though not significant statistically ($p > 0.05$).

The Clinical attachment level was reduced by 0.73 (19.26%) and 0.93 mm (24.73%) on day 90 compared to day 0 in group A and B, respectively, which were found to be very highly significant statistically ($p < 0.001$). In contrast, Clinical attachment level in group C was increased by 0.07 mm on day 90 from day 0, though not significant statistically ($p > 0.05$).

Intergroup comparison between the group B and A revealed no statistically significant difference in the periodontal parameters ($p > 0.05$) except in plaque index ($p < 0.01$). Again, the differences between the group B and C, and between the group A and C, significant differences were observed in all the periodontal parameters ($p < 0.01$).

The fasting plasma glucose was reduced by 7.82 and 16.06 mg/dl on day 90 compared to that of day 0 in group A and B, respectively. Again, in group C, it was increased by 2.83 mg/dl. The postprandial plasma glucose was reduced by 15.64 and 24.47 mg/dl from day 0 to 90 in group A and B, respectively. However, these differences within the groups were not found significant statistically ($p > 0.05$).

Intergroup comparison among the groups (B *vs* A; B *vs* C and A *vs* C) revealed a highly statistically significant difference in all the metabolic parameters ($p > 0.01$).

Discussion

DM and periodontal diseases are thought to be associated biologically. Various possible mechanisms have been proposed regarding their influence on each other [2-11] and also a high incidence and severity of periodontal disease is reported in diabetics compared to that of non-diabetics [19, 20, 21]. Similarly, improvement in the glycemic level following periodontal therapy have also been reported in various studies [1, 13, 22-29]. In contrast, few other studies failed to conclude any positive effect of periodontal therapy on glycemic level [30-34]. Thus, the effect of periodontal therapy on glycemic level remains to be questionable.

For the present study, subjects with type 2 DM having chronic periodontitis were selected, because both type 2 DM and chronic periodontitis are highly

prevalent among the adults; and type 2 DM has shown a spectacular increase in the past few decades as infections including periodontitis results in increased insulin resistance [6-9]. One of the important point noted in the present study is that significant reduction in HbA1c levels in Group B which received systemic doxycycline in addition to scaling and root planing, while group A received only scaling and root planing. It may be due to the fact that antimicrobial therapy in addition to scaling and root planing reduces circulating TNF-α, which further reduces the levels of circulating insulin and HbA1c [18, 22].

Conclusions

In the light of the present study carried out in subjects with type 2 DM having chronic periodontitis, we may conclude that reduction in plaque, probing pocket depth and gingival inflammation and gain in clinical attachment level was observed significantly after SRP and/or in combined treatment of SRP and doxycycline. Fasting plasma glucose and 2 hour postprandial plasma glucose and HbA1c were significantly reduced with the combined treatment of SRP and doxycycline, though the reduction was noted after SRP also. Thus, adjunctive doxycycline therapy plays an important role in reducing HbA1c to a significant extent.

References

1. Paleker F, van der Vyver PJ Comparison of Canal Transportation and Centering Ability of K-files, ProGlider File, and G-Files: A Micro-Computed Tomography Study of Curved Root Canals. J Endod. 2016 Jul;42(7):1105-9.
2. Kwak SW, Ha JH, Lee CJ, El Abed R, Abu-Tahun IH, Kim HC Effects of Pitch Length and Heat Treatment on the Mechanical Properties of the Glide Path Preparation Instruments. J Endod. 2016 May;42(5):788-92.
3. Coelho MS, Fontana CE, Kato AS, de Martin AS, da Silveira Bueno CE Effects of Glide Path on the Centering Ability and Preparation Time of Two Reciprocating Instruments. Iran Endod J. 2016 Winter;11(1):33-7.
4. Hiran-us S, Pimkhaokham S, Sawasdichai J, Ebihara A, Suda H Shaping ability of ProTaper NEXT, ProTaper Universal and iRace files in simulated S-shaped canals. Aust Endod J. 2016 Apr;42(1):32-6.
5. Topçuoğlu HS, Düzgün S, Akpek F, Topçuoğlu G Effect of glide path and apical preparation size on the incidence of apical crack during the canal preparation using Reciproc, WaveOne, and ProTaper Next systems in curved root canals: A stereomicroscope study. Epub 2016 Nov;38(6):585-590.
6. Dhingra A. and Manchanda N Modifications in Canal Anatomy of Curved Canals of Mandibular First Molars by two Glide Path Instruments using CBCT. J Clin Diagn Res. 2014 Nov;8(11):ZC13-7.
7. Ruddle CJ, Machtou P, West JD Endodontic canal preparation: innovations in glide path management and shaping canals. Dent Today. 2014 Jul;33(7):118-23.
8. Dhingra A, Kochar R, Banerjee S, Srivastava P Comparative evaluation of the canal curvature modifications after instrumentation with One Shape rotary and Wave One reciprocating files. J Conserv Dent. 2014 Mar;17(2):138-41.
9. Nazarimoghadam K, Daryaeian M, Ramazani N An in vitro comparison of root canal transportation by reciproc file with and without glide path. J Dent (Tehran). 2014 Sep;11(5):554-9.
10. Kiran M, Arpak N, Unsal E, Erdoğan MF. The effect of improved periodontal health on metabolic control in type 2 diabetes mellitus. J Clin Periodontol. 2005; 32:266 - 72.
11. Salvi GE, Spets-Happonen S, Singer RE, Offenbacher S. Reconstitution of a hyperinflammatory prostaglandin E2 response to Porphyromonas gingivalis challenge in severe combined immunodeficient mice. J Periodontol. 2005; 76:16 - 21.
12. Frantzis TG, Reeve CM, Brown AL. The ultrastructure of capillary basement membranes in the attached gingiva of diabetic and non-diabetic patients with periodontal disease. J Periodonto1. 1971; 42:406-11.
13. Listgarten MA, Ricker FH Jr, Laster L, Shapiro J, Cohen DW. Vascular basement membrane lamina thickness in the normal and inflamed gingiva of diabetics and nondiabetics. J Periodontol. 1974; 45:676-84.
14. Seppala B, Sorsa T, Ainamo J. Morphometric analysis of cellular and vascular changes in gingival connective tissue in long-term insulin

dependent diabetes. J Periodontol. 1997; 68: 37-45.

15. Ramamurthy NS and Golub LM. Diabetes increases collagenase activity in extracts of rat gingiva and skin. J Periodontal Res. 1983). 18:23-30.

16. Noack B, Genco RJ, Trevisan M, Grossi S, Zambon JJ, Nardin ED. Periodontal infections contribute to elevated systemic C-reactive protein level. J Periodontol. 2001; 72:1221-7.

17. Mohamed-Ali V, Goodrick S, Rawesh A, Katz DR, Miles JM, Yudkin JS, Klein S, Coppack SW. Subcutaneous adipose tissue releases interleukin-6, but not tumor necrosis factor-α, in vivo. J Clin Endocrinol Metab. (1997); 82:4196-200.

18. Natali A, Toschi E, Baldeweg S, et al. Clustering of insulin resistance with vascular dysfunction and low-grade inflammation in type 2 diabetes. Diabetes. 2006; 55:1133-40.

19. Salvi GE, Collins JG, Yalda B, et al. Monocytic TNF-α secretion patterns in IDDM patients with periodontal diseases. J Clin Periodontol. 1997; 24:8-16.

20. Mealey BL and Oates TW; American Academy of Periodontology. Diabetes mellitus and periodontal diseases. J Periodontol. 2006; 77:1289-303.

21. Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiologic perspective. Ann Periodontol. 2001; 6:99-112.

22. Eugene A. Pantera.."Sterilization of extracted human teeth."*J. Dent. Edu1990.* .54 .4,.283-285.

23. Feagin F., T. Koulourides,W.Pigman. ."The characterization of enamel surface demineralization ,remineralization,and associated hardness changes in human and bovine enamel."*Archs. Oral. Bio1969* .14,.1407-1417.

24. Finn Brudevold.."Study of the phosphste solubility of the human enamel sueface*."J Dent.Res1948*..27 3,.320-329.

25. Guranick W C. and Schulman L. B. July ."Tooth Transplantation."*DCNA1962* .499-511.

26. Gustafson M.B., Martin R. B., Gibson V., Storms D. H., Stover S. M., Gibeling J., Griffin LK. . "Calcium buffering is required to maintain bone stiffness in saline solution *." J. Biomech*.1996 .29, .1191-1194.

27. Helen B. . "Contaminant microbiota associated to extracted human teeth*." Rev. de Clin . Pesq. Odonto2004*..1 .2, out/dez.

28. Herkstroter F M, Witjer M, Ruben J, Arends J. ." Time dependency of micro-hardness indentations in human and bovine dentine compared human enamel." *Caries Res1989*, .23,.342-344.

29. Howard Martin. 1976. "Ultrasonic disinfection of the root canal." *O.Surg. O.Med. O.Path*. .1, .92-98.

30. Ingram G. S. ."Chemical events during tooth dissolution*." J. Dent. Res.1990* .69. .581-586.

31. Juliana Silva Moura,Lidiany Karla Azevedo Rogrigues,Altair Antoninha Del Bel Cury,Emilena Maria Xisto Lima, Renata Mathus cunha Rodrigues Garcia."Influence of storage solution on enamel demineralization submitted to Ph cycling*." J. Appl. Oral*. Sci.2004 12 . 3

32. Kanca J. ."Replacement of a fractured incisor fragment over pulpal exposure".*Quintessence Int.1993* .24,.81-84.

33. Kodaka, Debri, Yamada, Kuroiwa.."Correlation between microhardness and mineral content in sound human enamel." *Caries Res1992*,.26,.139-141.

34. Kumar M,Sequeira P S,Peter S, Bhat GK.."Sterilization of extracted human teeth for educational use."2005 .23 .4,.256-258.

35. Lee S. Y., Lin C. T.." Storage effect on dentine substrate and on resultant composite bond strengths."*J. Oral. Rehabiltation*.1997.24,.823-834.

36. Laird W.R.E., Walmsley A. D.."Ultrasound in dentistry.Part-1 Biophysical reaction." *J Dent.1991* .19,.14-17.

37. Lidiany Karla Azevedo Rodrigues,Jaime Aparecido Cury and marines Nobre dos Santos."The effect of gamma radiation on enamel hardness and its resistance to demineralization in vitro."

38. Miklos Cserepfalvi, Paul J. Price. ."Transplantation of a preserved human tooth to monkey.Preliminary report of case*." J. Dent. Res1968*. 47 .4,.641-643.

39. Mosovich H, Creugars.."The novel use of extracted teeth as a dental restorative material-the 'Natural inlay'*." Journal of dentistry1998*, .26 .1. .21-24.

40. Carlson T, Reed JF., 3rd A case-control study of the risk factors for toe amputation in a diabetic population. Int J Low Extrem Wounds. 2003;2:19–21.[PubMed: 15866823].

41. Mayfield JA, Reiber GE, Nelson RG, Greene T. A foot risk classification system to predict diabetic amputation in Pima Indian. Diabetes Care. 1996;19:704–09.[PubMed: 8799623]