Role Of Periodontal Therapy On Glycemic Control-A Systematic Review

Dr. Neelam Rana*, Dr. Sachit Anand Arora, Dr. Rupali Kalsi***, Dr. Kumar Saurav******

*Final Year PG Student, **HOD & Principal,***Professor,****Reader, I.T.S Dental College, Hospital And Research Centre ,Knowledge Park –III, Greater Noida, Uttar Pradesh,201301,India

Abstract: Background: Periodontitis is a term used to describe an inflammatory process ,which is initiated by the plaque biofilm that leads to the loss of periodontal attachment from adjacent alveolar bone and surface of root ultimately results in tooth loss. Although, periodontitis is bacterial infection associated with gram negative anaerobes, in recent years, a two-way correlation has been postulated between periodontitis and diabetes mellitus. It has been found that periodontal diseases may increase the severity in subjects exhibiting diabetes mellitus**.** Aim: The aim of the present study was role of periodontal therapy on glycemic control-a systematic review. Material And Methods: A Systematic review of clinical trials assessing the relationship between DM and chronic periodontitis. Electronic search based on internet sites (From2009-2019) by MEDLINE,PubMed,Google Scholar and SCOPUS were used. Result: On basis of this systemic review it can be concluded that non-surgical periodontal therapy is advantageous in clinical parameters and serum HbA1c levels in chronic periodontitis patients suffering from diabetes mellitus. Conclusion: Recent evidence and literature suggests that there exists a strong interconnection between DM and chronic periodontitis. Diabetic patients with periodontal disease have two chronic conditions, of which may affect each other, and require regular professional evaluations, patient education and consistent educational reinforcement by health care providers both medical and dental. [Rana N Natl J Integr Res Med, 2021; 12(3):79-86]

Key Words: Diabetes mellitus; periodontal diseases; periodontal therapy

Author for correspondence: Dr. Neelam Rana, Final Year PG Student, I.T.S Dental College, Hospital And Research Centre, Knowledge Park –III, Greater Noida, Uttar Pradesh- 201301, India. Mobile: 9654333271 E-Mail: Neelam_mds18_21_gn@its.edu.in

Introduction: Periodontitis is inflammatory disease of supporting tissues of the teeth that is initiated by the formation of plaque and other retentive factors which further leads to loss of attachment from the root surface and adjacent alveolar bone loss causing tooth loss. Periodontal diseases include 2 major forms i.e gingivitis and periodontitis. In gingivitis the inflammation is confined to the gingiva whereas in periodontitis inflammation extends to alveolar bone and results in tissue destruction and alveolar bone resorption[10]. Diabetes has been unequivocally confirmed as major risk factor for the periodontitis[2]. Chances of risk of periodontitis is usually increased by approximately threefold in a diabetic individuals compared with non-diabetic individuals.Diabetes mellitus(DM) is basically clinical and genetical heterogeneous group of metabolic disorders which is manifested by abnormally high levels of the glucose in the blood due to a deficiency of insulin secretion or resistance to insulin action[1]. Oral Manifestations of diabetic patients includes conditions like cheilosis, mucosal drying and cracking, burning mouth and tongue, diminished salivary flow, and alterations in the flora of the oral cavity[5].

The bacterial pathogens in patients with type 1 diabetes mellitus and periodontitis have a subgingival flora composed mainly of Capnocytophaga, anaerobic vibrios, and Actinomyces species.,Porphyromonas gingivalis, Prevotella intermedia, and Aggregatibacter actinomycetemcomitans, which are common in periodontal lesions of individuals without diabetes.

Several studies have been reported which explain the potential mechanisms involving interactions with periodontitis, diabetes, metabolic control, tissue repair, and immune cell function.

Periodontal destruction have been seen in periodontitis which is host-mediated through the release of proinflammatory cytokines by the local immune cells in response to bacterial flora and products/metabolites, especially lipopoly-saccharide (LPS)[9].Tumoral necrosis factor alpha (TNF-α) and interleukin 1 beta (IL-1β) are observed to be significantly elevated in the periodontal disease sites and they also demonstrates inflammation during the periods of active phase of disease and tissue destruction[23].

It has been found that scaling and root planing resulted in significant reduction in the clinical parameters such as gingival index, plaque index, clinical attachment levels probing pocket depth, HbA1c and serum blood glucose[19,8].

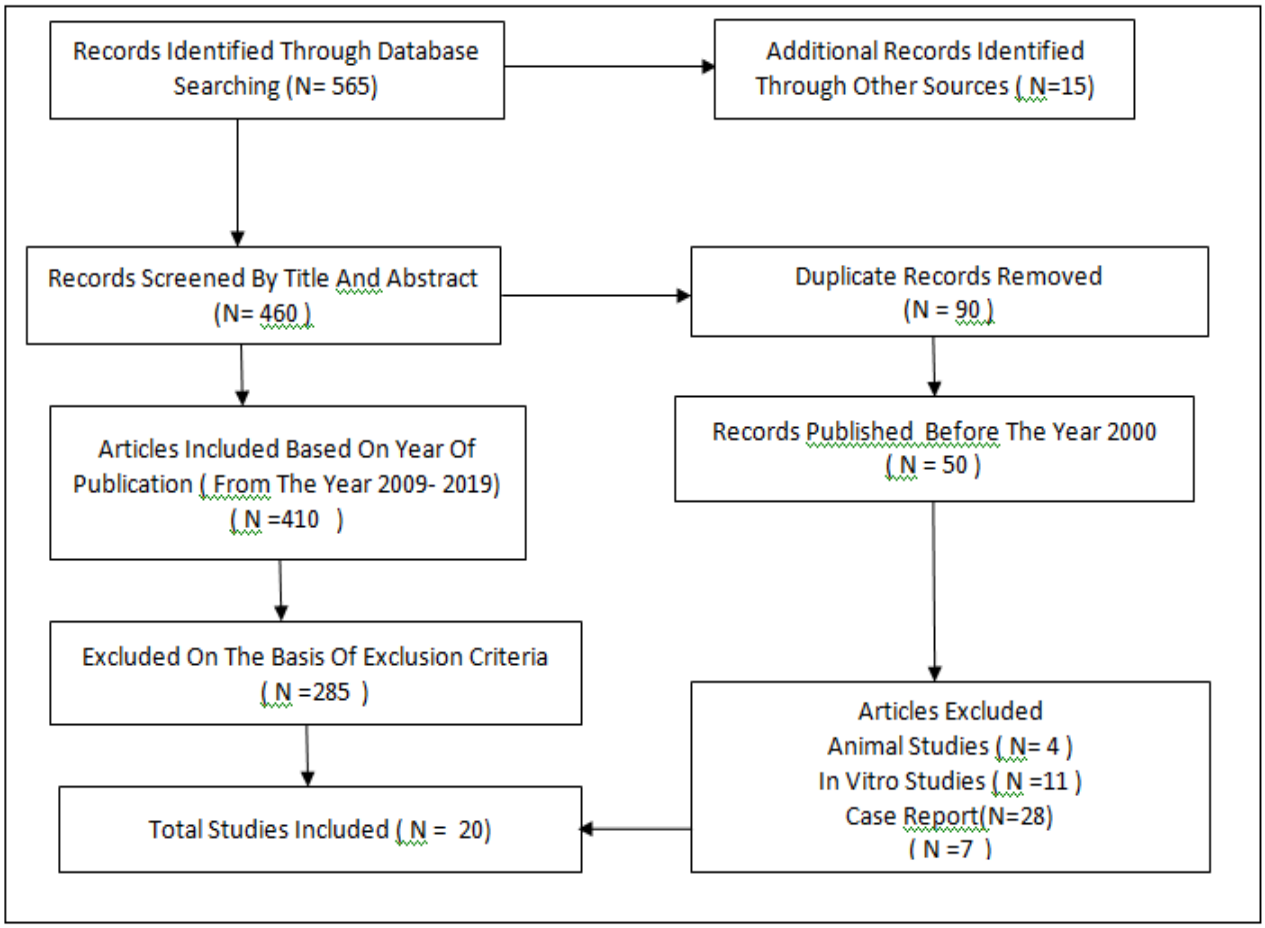
Material & Methods: The systematic review was conducted based on PRISMA.The research question was explored using the PICO method.The research question were: Is there any effect of periodontal therapy on glycemic control of patients with periodontal disease?

Search Strategy: An electronic search of MEDLINE,PubMed,Google Scholar and SCOPUS was carried out considering articles published upto December 2019 in English language.

Inclusion Criteria: Randomized clinical trial, Type II- DM with chronic periodontitis, Minimum 1-6 months follow-ups, No major diabetic complications, Non-surgical periodontal therapy.

Exclusion Criteria: Studies published in language other than English, animal Studies, case reports, systemic reviews, studies with only abstract is there, case series, letter to editor, comment articles, Type I diabetes, Meta analysis(Figure1).

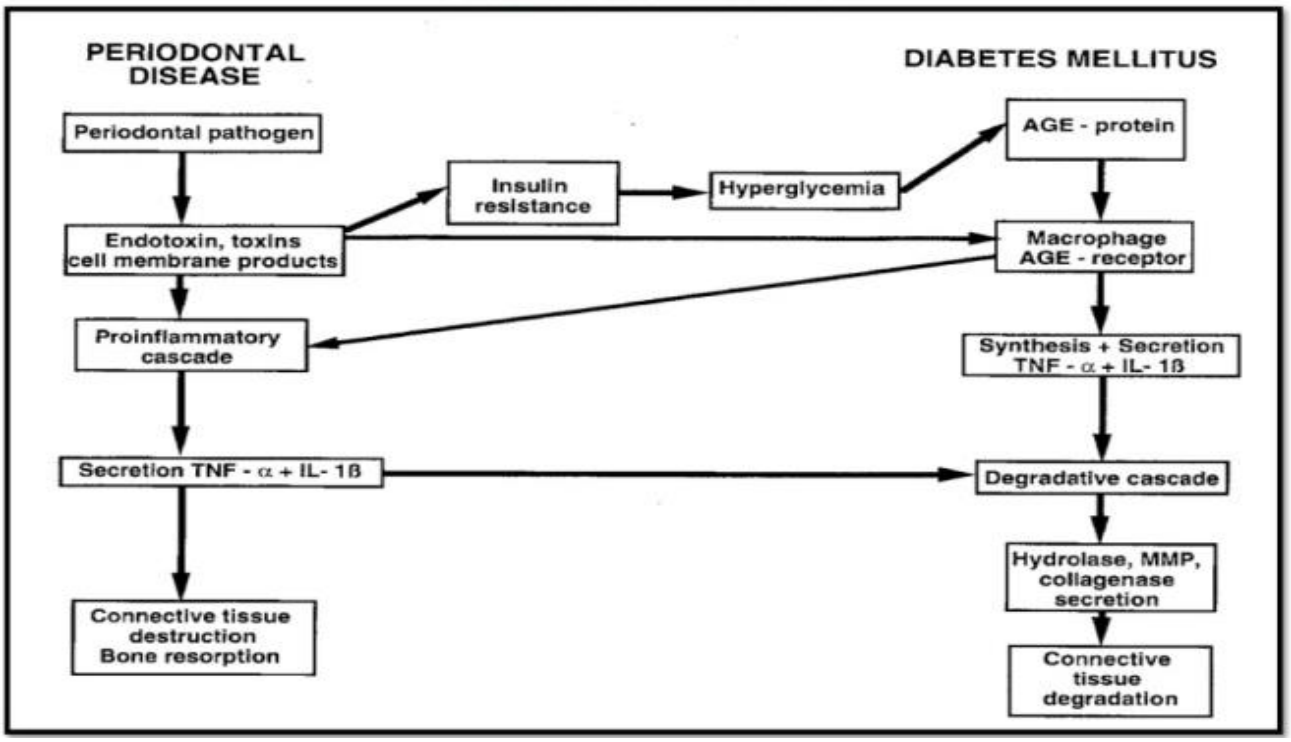
Figure 1: Study Design



Association Between Diabetes Mellitus And Periodontal Diseases[9,10,12,14] : It is found that in the reverse direction, CP has the potential to impact the control of diabetes, its associated complications, and also its incidence[14]. A bi-directional relationship between diabetes and CP has been recognized for some time with the majority of studies focusing on the relationship with type 2 diabetes[10]. The early studies supporting a bi-directional relationship were predominantly cross-sectional in design, precluding the ability to firmly demonstrate direction(Figure2). According to **Stewart et al** found that periodontal treatment for 9 months has 17.1% improvement in glucose levels compared to those of the control groups.

Whereas, **Koromantzos PA et al** [13] in his study found that there is a significant improvement in the intervention group and glycosylated haemoglobin levels decreased significantly more in intervention group versus control group.

Figure 2:-Two Way Relationship Between Periodontitis And Diabetes Mellitus



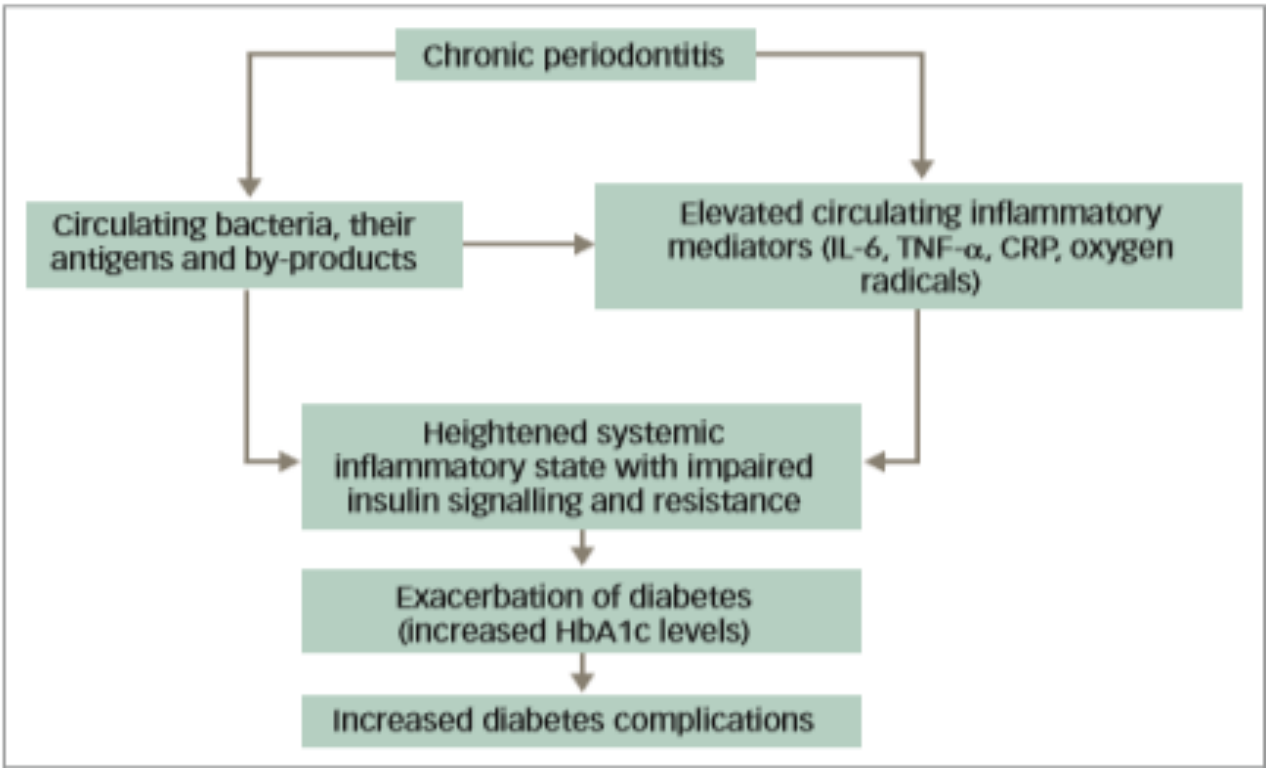
Results: A systematic review methodology was followed and the studies were identified based on the PICO principle. Studies on patients with Type II- DM with chronic periodontitis having minimum of 1-6 months follow-ups with no major diabetic complications were selected. The database searching was done which yielded 90 duplicate records , which were removed from total of 565 ,leaving 460 records to be screened further .Only records published in last 10 years were included , 28 records were excluded on the basis of language other than English. From a total of 460 articles ,272 articles excluded. A total of 285 articles were further evaluated,on the basis of exclusion & inclusion criteria and 265 records were removed. Total studies that were systematically reviewed came out to be 20.

On basis of this systemic review it can be concluded that non surgical periodontal therapy is advantageous in clinical parameters and serum HbA1c levels in chronic periodontitis patients suffering from diabetes mellitus.

Discussion: According to American Diabetes Association, in 1993, periodontal disease is termed as the sixth complication of diabetes mellitus[10]. Prevalence of periodontal disease among individuals with inadequately controlled type 2 diabetes mellitus is generally higher than that of people free of systemic disorder[9].The mechanism (Figure3) associated with periodontitis found in diabetic patients is the increased accumulation of advanced glycation end products (AGEs), which would affect the migration and phagocytosis of polymorphonuclear and mononuclear cells, producing a subgingival flora with a predominance of gram negative anaerobes according to Galea H et al[7].The purpose of this review is to focus on correlation between diabetes mellitus and chronic periodontitis .Various clinical parameters recorded to check this correlation are CAL , PPD , PI, GI, GR for periodontitis and DM was assessed by serum HbA1c & FBG levels.

Plaque is primary etiological agent in progression of periodontal disease. Both quality and quantity of plaque are been reported to alter in DM patients with chronic periodontitis[11]. So Plaque Index serves as an important parameters in diagnosis & deciding the treatment protocol of patients with chronic periodontitis suffering from DM. Bleeding on probing is easily detected clinically and therefore it is of value for the early diagnosis & prevention of gingivitis. It is seen that bleeding on probing appears earlier than change in colour or other visual sign of inflammation. Increasing pocket depth and clinical attachment loss are two measures of progression of periodontal disease. All of these parameters in the studies which are selected were measured by first generation probe.

Figure3: Mechanism Leading To Increased Diabetes Complication In Chronic Periodontitis



In this systemic review, various studies were short listed in which efficacy of non-surgical periodontal therapy was assessed in comparison to povidine /chlorohexidine mouthwash /diode lasers. Various advantages of nonsurgical periodontal therapy are reported in literature as enumerated below[21],

- Effective in treatment of Bacterial, fungal, & viral infection
- Elimination of bacteria in supragingival & subgingival plaque.
- Treatment of different type of periodontal disease like gingivitis.
- As an adjunct for bacterial elimination in treatment of periimplantitis.

Koromantzos PA et al[13], 2011 did a randomized controlled clinical trial to evaluate the effect of non-surgical periodontal therapy in patients with type 2 DM. Results demonstrated that intervention group showed statistically significant decrease in clinical parameters like pocket probing depth, clinical attachment level, gingival index and serum HbA1c d as compared with the control group. They also reported that decrease of periodontal inflammation was independently associated with the glycemic improvement.

Similar studies were also reported by Engebretson SP (2013)[21] in which intervention group showed statistically significant improvement in clinical parameters and HbA1c level in intervention group when compared with the control group.

Engebretson SP (2013)[21] did randomized controlled trial to survey & compare the benefits of non-surgical periodontal treatment in patients with type 2 diabetes mellitus & chronic periodontitis.

Results demonstrated that intervention group showed improved periodontal status & the significant improvement in metabolic control at 6 months after non-surgical periodontal treatment.

Moreover, the periodontal status & metabolic control in the control group remained unchanged.

Quintero AJ et al[16,]2018 did randomized clinical trial to demonstrate & compare the effect of two periodontal treatment modalities in patients with uncontrolled type 2 diabetes mellitus.

At 6 months,HbA1c level decreased i.e 0.48% in the treatment group & 0.18% in the control group.Also, the periodontal parameters like PPD,CAL,GI were improved significantly ($p<0.0001$) after scaling and root planning.

TABLE 1:-Meta-Analysis Evaluating Relationship Between Diabetes Mellitus And Periodontitis CAL-Clinical Attachment Level,PPD-Pocket Probing Depth,GI-Gingival Index,PI-Plaque Index,BOP-Bleeding On Probing

Study	Study Design	Intervention	Clinical Outcome Measure	Conclusion
UNIVERSITY OF YAOUNDE, YAOUNDE 2018	34 Patient =Total Group A=17(I) Group B=17(c) (3 months follow)	Group A=SRP+10% Povidine iodine subgingival irrigation Group B=Delayed periodontal treatment 3 month later	AT BASELINE= **GBI** 39.5 ±18.9 **PPD** 3.0±0.4 **CAL**3.4±0.5 **PI** 79.3±19.3 AT 3 MONTHS **GBI** 4.2 **PPD** 1.9 **CAL** 2.1 **PI** 18.3 They also show significant reduction in TNF-α Level as well as fasting glucose level	Non-surgical periodontal treatment markedly improved glycemic control with reduction of HbA1c in poorly controlled Type 2DM Patient
OHIO STATE UNIVERSITY, US 2017	40patients=Total Treatment Group=20 Control =20 (0-3-6 months)	Treatment group=SRP+OHI Control=OHI	**AT BASELINE**= CONTROL GROUP PPD 2.4±0.7 CAL 2.7±0.9 INTERVENTION PPD=2.6±0.7 CAL 2.7±0.9 **AT 3 MONTHS** CONTROL GROUP PPD2.5±0.8 CAL 2.7±1.0 INTERVENTION GROUP PPD2.2±0.6 CAL2.4±0.6 **AT 6 MONTHS(C)** PPD 2.6±0.9 CAL2.8±1.0 I=PPD 2.2±0.5 CAL 2.4±0.6	Change in HbA1c level were not significantaly different from the control group at 3 & 6 months In Type 2DM Patients NSP improved systemic stress balance but did not decreased HbA1c levels at 3 & 6 months.
CHILE 2018	93 patients=Total I Group=46 C Group= 47 (0-3-6 months follow up)	I=SRP IN 24 hrs C=SRP Quadrant wise	**AT BASELINE** Intervention Group **PPD** 3.10±0.66 **GI** 1.5±0.2 **CAL** 3.95±1.30 Control Group= **PPD** 3.0±0.8 **GI** 1.6±0.2 **CAL** 4.2±1.7 **AT 6 MONTHS** Intervention Group **PPD**0.72(P<0.001) Control Group= **PPD** 0.71(P<0.001) **GI** 0.31(P<0.001) **CAL**0.71(P<0.001) **PPD** 0.71(P<0.001) **GI** 0.31(P<0.001) **CAL** 0.71(P<0.001)	Periodontal therapy had greater impact on reduction of HbA1c level & Significant improvement in parameters Non-surgical periodontal therapy improved glycemic control in type 2 DM patients.

Study	Study Design	Intervention	Clinical Outcome Measure	Conclusion
PALKA K.KUAR,SATISH C.NARULA , PG INSTITUTE OF DENTAL SCIENCE,ROTHAK 2015	100 Patients=Total Intervention=48 Control group =52 (0-3-6 months follow)	I=SRP C=no treatment	**AT BASELINE** Treatment Group= **PPD** 12.24±3.52 **CAL** 3.46±0.53 **GI** 0.64±0.26 **PI** 1.64±0.26 **BOP** 73.68±14.63 Control Group= **PPD** 11.82 **CAL** ±0.61 **GI** 1.63±0.17 **PI** 1.63±0.26 **BOP** 75.36±10.49 **AT 6 MONTHS** Treatment Group= **PPD** 5.94±2.91 **CAL** 2.75±0.62 **GI** 0.64±0.26 **PI** 0.28±0.09 **BOP** 38.96±11.62 Control Group= **PPD** 14.98±8.09 **CAL** 3.40±0.64 **GI** 1.75±0.32 **PI** 1.68±0.34 **BOP** 78.88±11.84	PPD,CAL,GI,BOP & HbA1c level significantly improvement in intervention group.
KOTHIWAL DENTAL, MORADABAD 2013	60 Patients=Total Group A=20(I) Group B=20(I) Group c=20(control group) (3 months follow)	I Group A=SRP+0.12% Cholorhexidine Mouthwash I Group B=0.12% Chlorhexidine C Group c=brush twice daily	**AT BASELINE** Treatment Group= **PPD** 5.05±0.70 **GI** 2.16±0.46 **PI** 1.88±0.12 Control Group= **PPD**5.05±0.69 **GI** 2.16±0.46 **PI** 1.88±0.12 **AT 3 MONTHS** Treatment Group= **PPD** 4.59±0.72 **GI** 1.59 **PI**1.05±0.04 Control= **PPD** 5.03 **GI** 2.19±1.08 **PI** 1.86±0.04	HbA1c levels of patients with Periodontitis were significantly reduced after 3 months of non-surgical periodontal therapy

Conclusion: It has been proved beyond doubt that DM & chronic periodontitis have a bidirectional association. But there exist a dilemma on the effectiveness of periodontal therapy in improving glycemic contents of DM patients with chronic periodontitis. The results indicated that the use of periodontal therapy along with hypoglycemic drugs has significant impact on improving glycemic control & periodontal parameters of the chronic periodontitis patients with DM. The improvement in periodontal status was independently associated with improvement in glycemic control in multiple linear regression.Thus it is advisable that regular periodontal visits should be incorporated in the follow up of DM patients to reduce the incidence of any complications as well as reduce the progression of periodontal disease. Furthermore studies are required to emphasise the importance of periodontology in management of patients with systemic disease such as DM.

References:

1. Centers for Disease Control and Prevention. 2011 National diabetes fact sheet. US Department of Health and Human Services, Centers for Disease Control and Prevention. 2011 Jan 30.
2. Adler P, Wegner H, Bohatka L. Influence of age and duration of diabetes on dental development in diabetic children. Journal of dental research. 1973 May;52(3):535-7.
3. Bernick SM, Cohen DW, Baker L, Laster L. Dental disease in children with diabetes mellitus. Journal of periodontology. 1975 Apr;46(4):241-5.
4. Gottsegen R. Dental and oral considerations in diabetes mellitus. New York state journal of medicine. 1962 Feb 1;62:389-95.
5. Mascola Jr RF. The Oral Manifestations of Diabetes Mellitus. A Review. The New York state dental journal. 1970 Mar;36(3):139-42.
6. FALK H, HUGOSON A, THORSTENSSON H. Number of teeth, prevalence of caries and periapical lesions in insulin-dependent diabetics. European Journal of Oral Sciences. 1989 Jun;97(3):198-206.
7. Galea H, Aganovic I, Aganovic M. The dental caries and periodontal disease experience of patients with early onset insulin dependent diabetes. International Dental Journal. 1986 Dec 1;36(4):219-24.
8. Tervonen T, Knuutlila M, Pohjamo L, Nurkkala H. Immediate response to non-surgical periodontal treatment in subjects with diabetes mellitus. Journal of Clinical Periodontology. 1991 Jan;18(1):65-8.
9. Hirschfeld I. Periodontal symptoms associated with diabetes. The Journal of Periodontology. 1934 Jan;5(1):37-46.
10. Löe H. Periodontal disease: the sixth complication of diabetes mellitus. Diabetes care. 1993 Jan 1;16(1):329-34.
11. Cianciola LJ, Park BH, Bruck E, Mosovich L, Genco RJ. Prevalence of periodontal disease in insulin-dependent diabetes mellitus (juvenile diabetes). The Journal of the American Dental Association. 1982 May 1;104(5):653-60.
12. Ainamo J, Lahtinen A, Uitto VJ. Rapid periodontal destruction in adult humans with poorly controlled diabetes A report of 2 cases. Journal of Clinical Periodontology. 1990 Jan;17(1):22-8.
13. Koromantzos PA, Makrilakis K, Dereka X, Katsilambros N, Vrotsos IA, Madianos PN. A randomized, controlled trial on the effect of non-surgical periodontal therapy in patients with type 2 diabetes. Part I: effect on periodontal status and glycaemic control. Journal of clinical periodontology. 2011 Feb;38(2):142-7.
14. Kıran M, Arpak N, Ünsal E, Erdoğan MF. The effect of improved periodontal health on metabolic control in type 2 diabetes mellitus. Journal of clinical periodontology. 2005 Mar;32(3):266-72.
15. Mauri-Obradors E, Merlos A, Estrugo-Devesa A, Jané-Salas E, López-López J, Viñas M. Benefits of non-surgical periodontal treatment in patients with type 2 diabetes mellitus and chronic periodontitis: A randomized controlled trial. Journal of clinical periodontology. 2018 Mar;45(3):345-53.
16. Quintero AJ, Chaparro A, Quirynen M, Ramirez V, Prieto D, Morales H, Prada P, Hernández M, Sanz A. Effect of two periodontal treatment modalities in patients with uncontrolled type 2 diabetes mellitus: A randomized clinical trial. Journal of clinical periodontology. 2018 Sep;45(9):1098-106.
17. Kaur PK, Narula SC, Rajput R, Sharma RK, Tewari S. Periodontal and glycemic effects of nonsurgical periodontal therapy in patients with type 2 diabetes stratified by baseline HbA1c. Journal of oral science. 2015;57(3):201-11.
18. Telgi RL, Tandon V, Tangade PS, Tirth A, Kumar S, Yadav V. Efficacy of nonsurgical periodontal therapy on glycaemic control in type II diabetic patients: a randomized controlled clinical trial. Journal of periodontal & implant science. 2013 Aug;43(4):177.
19. Montoya Carralero JM, Saura Pérez MJ, Canteras Jordana M, Morata Murcia IM. Reduction of HbA1c levels following nonsurgical treatment of periodontal disease in type 2 diabetics.
20. Santos VR, Lima JA, De Mendonça AC, Braz Maximo MB, Faveri M, Duarte PM. Effectiveness of full-mouth and partial-mouth scaling and root planing in treating chronic periodontitis in subjects with type 2 diabetes. Journal of periodontology. 2009 Aug;80(8):1237-45.
21. Engebretson SP, Hyman LG, Michalowicz BS, Schoenfeld ER, Gelato MC, Hou W, Seaquist ER, Reddy MS, Lewis CE, Oates TW, Tripathy D. The effect of nonsurgical periodontal therapy on hemoglobin A1c levels in persons with type 2 diabetes and chronic periodontitis: a randomized clinical trial. Jama. 2013 Dec 18;310(23):2523-32.

22. Tsobgny-Tsague NF, Lontchi-Yimagou E, Nana AR, Tankeu AT, Katte JC, Dehayem MY, Bengondo CM, Sobngwi E. Effects of nonsurgical periodontal treatment on glycated haemoglobin on type 2 diabetes patients (PARODIA 1 study): a randomized controlled trial in a sub-Saharan Africa population. BMC oral health. 2018 Dec;18(1):1-8.
23. Kumar M, Bandyopadhyay P, Mishra L, Das S, Kundu PK, Mistry S. Effect of periodontal therapy on glycemic control and circulating TNF-α in type 2 diabetic patients. International Journal of Diabetes in Developing Countries. 2015 Jun;35(2):96-102.
24. Camargo GA, Lima MD, Fortes TV, Souza CS, Jesus AM, Almeida RP. Effect of periodontal therapy on metabolic control and levels of IL-6 in the gingival crevicular fluid in type 2 diabetes mellitus.
25. Mizuno H, Ekuni D, Maruyama T, Kataoka K, Yoneda T, Fukuhara D, Sugiura Y, Tomofuji T, Wada J, Morita M. The effects of non-surgical periodontal treatment on glycemic control, oxidative stress balance and quality of life in patients with type 2 diabetes: a randomized clinical trial. PloS one. 2017 Nov 16;12(11):e0188171.

Conflict of interest: None
Funding: None
Cite this Article as: Rana N, Arora S, Kalsi R, Kumar S. Role Of Periodontal Therapy On Glycemic Control-A Systematic Review. Natl J Integr Res Med 2021; Vol.12(3): 79-86