

Diabetes and Periodontal Diseases

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Periodontal Diseases

- Periodontal diseases result from chronic inflammation in the periodontal tissues initiated by the accumulation of subgingival biofilm.
- Chronic inflammation in periodontium leads to irreversible loss of attachment, breakdown of periodontal ligament fibres and alveolar bone resorption.
- Periodontal diseases have multiple negative impacts on daily function, quality of life, comfort, self-confidence, as well as social interactions.
- Periodontitis is a multi-factorial disease, caused by number of factors independent of plaque level – one of the major risk factors for periodontal diseases is diabetes.
- Diabetes is associated with increased prevalence and severity of periodontitis; and severe periodontitis is associated with poor glycemic control.

Diabetes

- Diabetes is a group of metabolic disorders characterized by hyperglycemia (elevated blood sugar level):
 - 1) Type 1 Diabetes (Insulin-dependent diabetes or juvenile diabetes)
 - Characterized by a failure to produce insulin due to autoimmune destruction of the insulin-producing pancreatic B-cells.
 - Genetics is a major risk factor. In susceptible individuals, onset appears to be triggered by environmental factors (ex. Viral infections, diet).
 - Onset: Childhood or young adulthood.
 - Constitutes about 5-10% of all cases of diabetes but accounts for > 90% of cases in young population < 25 years old.
 - Complications: Hyperglycemia
 - (1) Acute Complication: Diabetic Ketoacidosis
 - (2) Chronic Complications: Neuropathy, nephropathy, cardiovascular disease, acute coronary syndrome
 - Management: Blood glucose monitoring and insulin therapy
 - 2) Type 2 Diabetes (Non-insulin dependent diabetes or Adult-onset diabetes)
 - Characterized by insulin resistance (Reduced responsiveness of the cells in the body to insulin → Reduced capacity to transfer glucose out of the circulation into cells → Hyperglycemia)
 - Constitutes 90-95% of all diabetes cases and associated usually with lifestyle factors (overweight/obesity, lack of exercise), and genetic factors.
 - Complications: Hyperglycemia
 - Management: Lifestyle changes, weight loss, dietary modification, oral hypoglycemic drugs, insulin injections (in severe cases).
 - 3) Gestational Diabetes
 - Characterized by temporary hyperglycemia (reduced insulin secretion and/or insulin resistance) developed during pregnancy in women without a previous history of diabetes.
 - Usually improves after pregnancy.

HbA1c and Glycemic Control

- The level of glycemic control is regularly assessed by the measurement of HbA1c (Glycated Hemoglobin) in the blood.
- The lifespan of a red blood cell is around 3 months – hence HbA1c measurements give an idea of glycemic control over 3 months.
- HbA1c used to be expressed in % of glycated hemoglobin; however, HbA1c is now reported in mmol/mol.
- Non-diabetic person HbA1c = ~5.5% (37 mmol/mol)
- Diabetic person HbA1c < 7.0% (53 mmol/mol) = Good glycemic control
- Goal for diabetic person = HbA1c < 6.5% (48 mmol/mol)
- Poor glycemic control is when HbA1c > 8-9% (64-75 mmol/mol)

- Hyperglycemia has serious negative consequences on multiple body systems (Leads to cardiovascular disease, renal disease, peripheral vascular disease, ocular disease, neuropathy).
- Diabetic complications are closely linked to the level of glycemic control.
- It has been shown that **each 1% reduction in HbA1c is associated with 21% reduction in deaths related to diabetes, 14% reduction in myocardial infarction, and 37% reduction for microvascular complications of diabetes** (Stratton *et al.*, 2000).

The Effects of Diabetes on Periodontal Diseases

- **People with diabetes are at (2-3 times) higher risk of developing periodontal diseases.**
- The increased risk of periodontitis is dependent on the level of glycemic control.
- In well controlled diabetes with HbA1c around 7% or lower, there appears to be little effect of diabetes risk for periodontitis; periodontitis risk increases exponentially as glycemic control deteriorates.
- In addition to periodontitis, diabetes may be associated with other oral conditions.
 - Many patients with diabetes take calcium channel blockers (Ex. Amlodipine and Nifedipine) for hypertension → risk for medication-related gingival hyperplasia.
 - Metformin can also lead to lichenoid mucosal reactions.
 - Diabetes also lead to xerostomia resulting in increased risk for caries, candida infections, and chronic mouth ulcers.
- The mechanisms that link diabetes and periodontitis is still not fully understood. However, it is well established that diabetes increase inflammation in periodontal tissues, with higher levels of inflammatory mediators such as IL-1B and TNF α (Engelbreton *et al.*, 2007).
- A cross-sectional study reported that an circulating TNF α (an inflammatory cytokine though to cause insulin resistance in type 2 diabetes) levels were positively correlated with severity of periodontal diseases (Engelbreton *et al.*, 2007).

The Effects of Periodontal Disease on Diabetes

- Studies observing the Gila River Indian Community with high prevalence of diabetes found that severe periodontitis is associated with increased risk of poor glycemic control (HbA1c > 90%), suggesting that periodontitis may be compromising diabetes glycemic control.
- People with advanced periodontitis exhibited increased prevalence of diabetes complications (retinopathy, neuropathy, and proteinuria).

- The incidence of macroalbuminuria was 2.0 to 2.6 times greater in people with moderate/severe periodontitis than people with no/mild periodontitis (Shultis *et al.*, 2007).
- The incidence of End Stage Renal Disease (ESRD) was 2.3 to 4.9 times greater in people with moderate/severe periodontitis than people with no/mild periodontitis (Shultis *et al.*, 2007).
- Age and sex-adjusted death rates (deaths per 1000 persons/year) from cardiovascular and diabetic neuropathy were 3.7 times higher for no/mild periodontitis, 19.6 times higher for moderate periodontitis, and 28.4% for severe periodontitis (Saremi *et al.*, 2005).
- Cardiorenal mortality (ischemic heart disease + diabetic neuropathy) was 3.2 times higher for diabetic patients with severe periodontitis compared to diabetic patients with no/mild/moderate periodontitis (Saremi *et al.*, 2005).
- A longitudinal study reported that non-diabetic participants with severe periodontitis at baseline had 5 times greater increase in HbA1c values over 5 years compared to participants without periodontitis at baseline (Demmer *et al.*, 2010).
- A recent cross-sectional pilot study reported that after multivariate regression analysis, it was found that HbA1c levels are positively associated with high probing pocket depth measurements (Wernicke K. *et al.*, 2018).

The Effect of Periodontal Treatment on Diabetes Control

- Periodontal treatment (conventional non-surgical periodontal therapy) has been associated with improvements in glycemic control in diabetic patients, with HbA1c reduction of approximately 0.4% following periodontal therapy (Teeuw *et al.*, 2010) – Clinical significance? The authors argued that any reduction of A1c will result in less diabetic complications (but how much less diabetic complications is unknown).
- A meta-analysis investigating four randomized-controlled trials (RCT) concluded that there are no significant differences in HbA1c levels between periodontal treatment group and control group (Wang *et al.*, 2014).
- Cochrane Review (2015) investigated 35 studies and concluded that there is “**low quality evidence that the treatment of periodontal disease by SRP improves glycemic control in people with diabetes**, with a mean percentage reduction in HbA1c of 0.29% at 3-5 months... there is insufficient evidence to demonstrate that this reduction is maintained after 4 months” (Simpson *et al.*, 2015).
- There is no evidence to support that one periodontal therapy is more effective than other in improving glycemic control (Simpson *et al.*, 2015).
- There is no evidence addition of systemic doxycycline to SRP significantly improve metabolic control in patients with diabetes and periodontitis (Wang *et al.*, 2014).

Take Home Message

- Periodontitis is a chronic inflammatory disease resulting in destruction of supporting tissues around teeth.
- Patients with diabetes are at a higher risk of developing periodontal diseases.
- Diabetic patients with severe periodontal diseases appear to be at a higher risk of diabetes complications.
- There is low quality evidence supporting that periodontal therapy improves glycemic control in patients with diabetes. In clinical practice, careful follow-ups and ongoing professional treatments beyond 6 months are required to maintain clinical improvements. Further investigation is needed to confirm this finding.

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