Diabetes as a risk factor for periodontitis

Individuals with uncontrolled diabetes are widely recognised to have an increased risk of periodontitis. There are several biological mechanisms which may increase this risk.

Effect of diabetes on the oral microbial flora

Diabetes appears to have a direct connection with the human microbiome and can significantly impact the body's microbial ecosystem. Recent developments in our understanding of the microbiome have shown that disruptions can disturb the delicate balance between the host and the normal oral microorganisms. When this equilibrium is disturbed, it can lead to dysbiosis (a microbial imbalance) which may trigger inflammation and encourage the growth of pathogenic bacteria (bacteria with the ability to cause disease) that further induce inflammation. However, conflicting results have been found from the research and there are limited large-scale research studies.

Effect of diabetes on the inflammatory burden in the periodontal tissues

The relationship between individuals' poor glycaemic control and periodontitis is largely driven by inflammation - a well-established mechanism connecting the two. This link is due to:

- Both conditions demonstrating strong inflammatory responses
- Both contributing to systemic inflammation that affects overall health,
- Extensive evidence demonstrating the role of inflammation in the development and progression of both conditions.

Various inflammatory pathways may be involved in linking uncontrolled diabetes to an increased risk of periodontitis, which involves:

- **Cytokines**
  - Human studies have shown elevated inflammatory markers in individuals with diabetes and periodontitis, which were increased further in those with poorly controlled diabetes. This is then thought to contribute to greater periodontal inflammation and subsequent tissue breakdown.
- **Hyperglycaemia and Advanced Glycation End Products (AGEs)**
  - Hyperglycaemia in diabetes leads to the formation of AGEs (proteins or lipids (fats) which are combined to sugar through a process called glycation). These molecules promote inflammation and oxidative stress. When AGEs bind to their receptor (RAGE), they trigger cellular changes that enhance inflammation and hinder tissue repair. This then results in enhancing inflammation and oxidative stress further. Studies have indicated that blocking RAGE in animal models with diabetes can reduce inflammation and tissue breakdown in the gingival tissues and suppress bone loss around teeth. This highlights how AGEs are a key factor in the increased severity of periodontitis in individuals with diabetes.
- **Bone Homeostasis**
  - Diabetes disrupts bone metabolism in periodontal tissues by increasing levels of receptor activator of nuclear factor-kappa B ligand (RANKL), a molecule that is secreted by T-cells and promotes bone resorption. In poorly controlled diabetes, RANKL levels are elevated, leading to more active bone resorption by osteoclasts (cells which are involved in bone resorption).

By **Dr Varkha Rattu** BDS MFDS RCS (Eng)

- **MicroRNAs**
  - MicroRNAs, which regulate gene expression, are increasingly recognised as important molecules in mediating pathogenic pathways. Certain microRNAs may influence inflammation, bone metabolism, and AGE-RAGE pathways, contributing to the interplay between these conditions. Future studies are needed to fully understand the role of microRNAs in the relationship of poorly controlled diabetes and periodontitis.

In summary, poorly controlled diabetes intensifies inflammation, periodontal destruction including bone loss, through increased cytokine release, AGE-RAGE interactions, and altered bone homeostasis, leading to more severe periodontitis.

References

Polak D, Sanui T, Nishimura F, Shapira L. Diabetes as a risk factor for periodontal disease-plausible mechanisms. Periodontol 2000. 2020 Jun;83(1):46-58. doi: 10.1111/prd.12298. PMID: 32385872.