BIDIRECTIONAL RELATIONSHIP BETWEEN PERIODONTAL DISEASE AND CHRONIC KIDNEY DISEASE AND NEED FOR PERIODONTAL THERAPY

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ABSTRACT

Periodontal disease caused by gram-negative bacteria leads to severe gum inflammation, periodontal pockets, and gum recession. Inflammatory markers of periodontal disease are associated with an increased risk of stroke, diabetes, cardiovascular disease, and chronic kidney disease. Chronic kidney disease is the gradual loss of kidney function and has been shown to impact oral mucosa and salivary glands negatively. Moreover, there is an established relationship between periodontal disease and a 5-10% decrease in kidney function capacity and a two-fold increase in the risk of chronic kidney disease. In this literature review, we investigate the bidirectional relationship between chronic kidney disease and periodontal disease and suggest the importance of periodontal therapy. Multiple studies were used to analyze the mechanism and relations of chronic kidney disease and periodontal disease with one another. We found that chronic kidney disease patients can face permanent bone degeneration, gum recession, and tooth loss due to phosphate and calcium metabolism dysregulation, leading to a high risk of periodontitis. Furthermore, patients undergoing hemodialysis were found to have increased dental calculus with high levels of serum phosphate. These findings indicate a higher concentration of phosphate and calcium in the saliva is linked to increased inflammation in periodontal diseases, and high phosphorus levels in urine are linked to systemic inflammation present in chronic kidney disease. Together, these data suggest that dysregulated phosphate metabolism is initiated when serum units have high phosphate levels. Therefore, this review advocates for periodontal treatment in patients with chronic kidney disease to reduce the systemic inflammatory response.

METHODS

Primary and Peer-reviewed scientific articles were analyzed to understand:

- The mechanism of CKD & PD.
- Linkage of CKD to PD through deregulation of phosphate, calcium metabolism & serum albumin levels
- PD leads to bone degression & tooth loss in patients with CKD, which leads to a decrease in nutritional intake

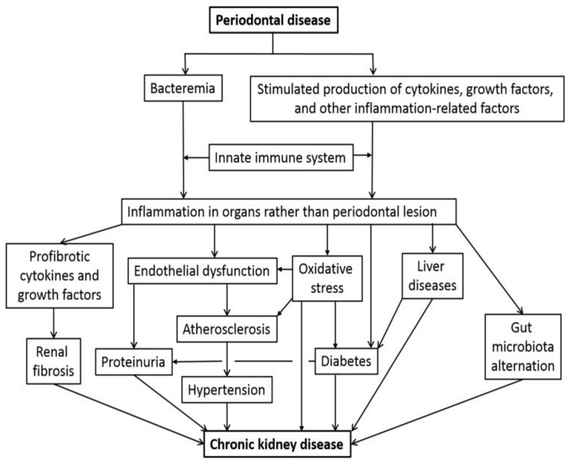

Figure 1. Impact of periodontal disease on the pathogenesis of chronic kidney disease. PD & CKD have many correlations, indicating that these two diseases affect one another. (Kitamura et al., 2019).

MECHANISM CHRONIC KIDNEY DISEASE

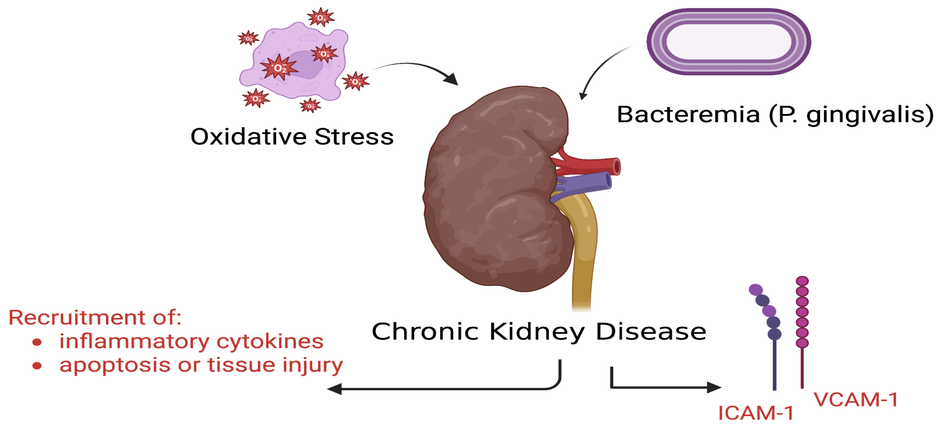

Figure 2. Progression of Chronic Kidney Disease. Oxidative stress leads to mitochondrial damage to the kidney—resulting in a lack of blood flow and recruitment of inflammatory cytokines or tissue injury. Proteinuria is one of the most critical surrogate markers of Kidney prognosis (high protein levels in urine)—result from inflammatory cytokines originating from bacteremia. Endothelial adhesion molecules such as ICAM-1 and VCAM-1 also serve as pathways to promote CKD. (IMAGE BIORENDER).

MECHANISM PERIODONTAL THERAPY

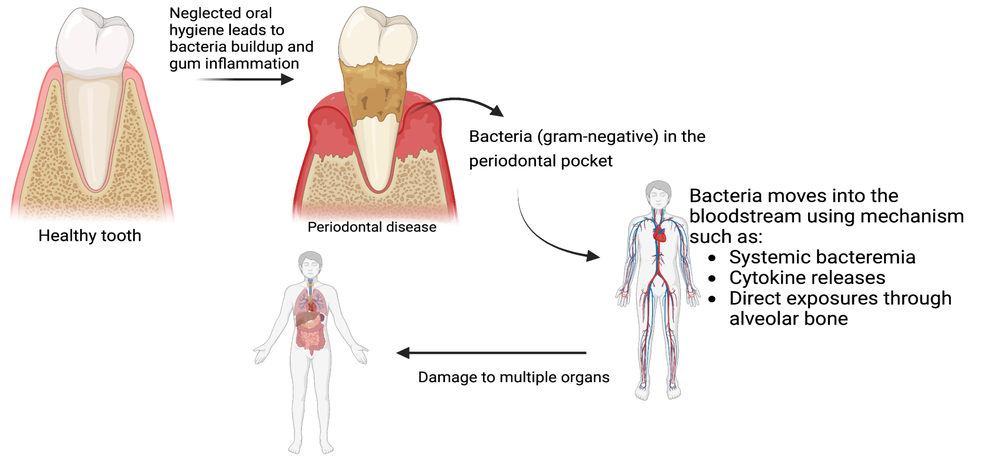

Figure 3. Progression of Periodontal Disease Poor oral hygiene leads to the buildup of gram-negative bacteria (P. gingival). The inflammatory process of PD can extend from the gingiva to the deep connective tissues. The periodontal pockets from the disease contain a high concentration of gram-negative biofilms; these large reservoirs travel into the bloodstream through systemic bacteremia, cytokine processing, or direct exposures through the alveolar bone destruction (bone containing the tooth sockets), invading the bloodstream and leading to organ failure. (IMAGE BIORENDER).

DYSREGULATION OF PHOSPHATE AND CALCIUM METABOLISM IN PD & CKD

PD increases Hyperphosphatemia in CKD

Severe PD decreases serum albumin levels in urine

↓

Increases Hyperphosphatemia

↓

Linked to systemic inflammation present in CKD and PD

CKD PT undergoing Hemodialysis increase Dental Calculus

Hemodialysis → Increased calculus + High levels of phosphate & calcium in salivary gland duct

↓

Inflammation → PD & increasing bone recession

→ Dysregulation of phosphate is initiated with high levels of phosphate & calcium

TOOTH LOSS IN PATIENT WITH CHRONIC KIDNEY DISEASE DECREASED NUTRITIONAL INTAKE

Metabolic Acidosis in CKD → Degrades proteins → Low albumin levels → Lower appetite → MALNUTRITION

Study performed among PT w/ CKD

→ cut off age was 60 years old & 3.7 g/dL

→ PT surveyed based on race, sex, age, diabetes status, BMI, and smoking

GROUP 1	GROUP 2
PT treated with complete or partial dentures and oral care. Greater chewing capacity increased dietary intake.	No dental treatment. Dietary intake was deficient, insufficient protein levels, and increased tooth loss.

CONCLUSIONS & FUTURE DIRECTION

CKD PT need a more immediate response to dental care due to PD & CKD having a bidirectional relationship.

In the US, 47.2% of the adult population (50–60 years old) is affected by PD.

- Start periodontal exams at age 22
- Proper at-home oral care

→ Dental plaques have declined by 36–65% when a mechanical toothbrush is used twice daily for 2 minutes compared to a manual toothbrush.

CHRONIC PERIODONTAL THERAPY

Figure 4. Periodontal therapy. Professionally cleaning the pockets around the teeth. (Emmy Dental Of Cypress, 2020).

→Inflammatory response in CKD PT stems from C-reactive proteins & IL-6

→ CKD PT undergoing 3 month periodontal therapy: lowered C-reactive proteins & IL-6

→ CKD induces systemic inflammatory response & periodontal therapy reduces this response

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REFERENCES