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Managing Periodontal Disease in a Patient Suffering From Renal Failure
Duane Keller, DMD



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Studies have shown an association between periodontal diseases and prevalent renal insufficiency that is treated with hemodialysis.¹ Research has demonstrated that patients on hemodialysis have an increased periodontal index that increases with the duration of the dialysis.² Periodontal disease is therefore an especially prevalent problem for patients with renal insufficiency.

A patient with renal failure, who was placed on dialysis, received an eventual kidney transplant, and antirejection drug administration, was evaluated over 4 years, 11 months. The clinician treated the patient using the Perio Protect Method, a direct application method that delivers antimicrobial agents to the periodontal pockets, eradicates the pathogens, and allows the host to heal. This article will discuss the management of periodontal disease in this patient who suffered from renal failure.

CASE REPORT AND DISCUSSION



Figure 1. As the patient's renal failure progressed she became aware of increasing pain in her teeth and gingival tissues. The probing in 2000 revealed Grade 4 gingivitis with 36 bleeding sites recorded.

A patient who initially presented without periodontal disease developed renal failure and ultimately received a kidney transplant. Conventional therapies proved ineffective in controlling the periodontal disease that eventually developed (Figure 1), so a customized and FDA-cleared patented medical device (Perio Tray [Space Maintainers]) was used, and the treatment results were evaluated for 4 years, 11 months. The objective was to evaluate the long-term outcome of patient-administered antimicrobial treatment for a patient with renal failure. The method utilized a direct delivery of antimicrobial agents to the periodontal pocket. The results yielded a significant improvement in pocket probing depth (all 3 mm or less), and the post-treatment Papilla Bleeding Index (one bleeding site) was retained though the use of the Perio Tray as part of the patient's home care program.

Grossi, et al³ demonstrated a relationship between bone loss and kidney disease. A patient's kidneys play a crucial role in balancing the calcium/phosphorus levels in the body. The kidneys remove most of the phosphorus we consume, unless their function becomes compromised. When the kidneys fail to remove the phosphorus, calcium is "pulled" from the bone to maintain the blood stream levels, and other systemic alterations occur.⁴ This can lead to a condition termed osteodystrophy that includes degrees of osteoporosis: osteomalacia (reduction of bone calcium), osteitis fibrosa (bone calcium replaces with fibrous scar tissue), and osteosclerosis (abnormal bone hardness). These conditions may be associated with an imbalance related to aluminum deposits in the bone from dialysis materials.⁵ These changes in the bone structure may help explain the incidence of periodontal disease if bone

calcium levels are modified or depleted, but other systemic changes also occur.

Patients with renal failure also face abnormalities in their polymorphonuclear neutrophil leukocytes (PMNs). The PMNs have an impaired ability to combat bacteria through an impaired chemotaxis and phagocytosis. This impaired PMN activity helps to partially explain the increased incidence of periodontal infections that occur with renal failure.

In addition to altered and decreased PMN activity, researchers have found in animal testing that osteoclastic activity increased in relation to the magnitude of the renal failure. This work discovered that the increased osteoclastic activity contributed to bone loss and an increased incidence of periodontal disease.⁶ Periodontal disease is therefore a significant consequence that many patients afflicted with renal failure have to address. All of these occurrences help to explain the deterioration that was clinically observed for the patient in this study.

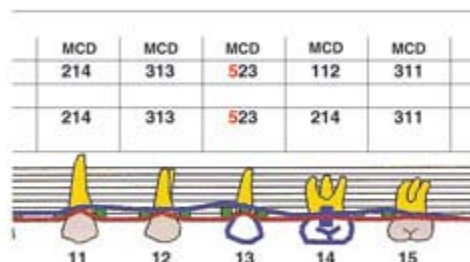


Figure 2. Prior to 1997 the patient had no periodontal pocket depth greater than 3 mm. Periodontal pocket depth analysis was recorded in 2000. The patient had generalized 4- and 5-mm pockets in addition to the generalized gingivitis. There was a generalized attachment loss as recorded on the graph.

The patient's medical conditions were initially diagnosed as renal disease in 1997 that continued to deteriorate to complete renal failure by 2000. The medical regimen included hemodialysis as she waited for a possible kidney transplant. The periodontal conditions were carefully monitored, and a slow deterioration of the tissue health mirrored her increased renal problems. In 2000 the patient was diagnosed with 4-mm and 5-mm pockets (Figure 2) and a generalized Grade 4 gingivitis using the Papilla Bleeding Index as an indicator of the disease. Conventional periodontal therapies involving scaling and root planing were provided on a 3-month basis, but the patient continued to suffer a deteriorating periodontal condition. The conventional therapy and the patient's home care were not sufficient to manage the increasing infection (gingivitis) or the increasing bone loss (periodontitis).

A patient-administered delivery method was selected for treatment that used a custom-fabricated tray with a patented seal that directs antimicrobial agents into the periodontal pocket while comfortably overcoming crevicular flow. The method directs medications of the dentist's choice into the gingival crevice (sulcus) or periodontal pocket and maintains an inhibitory level of medications in the infected region long enough to combat pathogens. The frequency and duration of medication usage is modified as the pathogens are managed and healing occurs.

Studies from Ohio University presented at the American Dental Education Administration/International Association of Dental Research meeting in 2006, using paired t-tests, demonstrated that the Perio Protect Method reduced pocket probing depth from a pretreatment value of 5.7 + 1.8 mm to 3.0 + 2.1 mm ($P < .00010$). The Papilla Bleeding Index went from 20.7 + 14 sites to 2.7 + 4.4 sites ($P = .002$). During the testing no new periodontal pockets formed and no new bleeding sites occurred.⁷ This method overcomes the crevicular flow to maintain the medication in the gingival sulcus for a sufficient period of time to combat the pathogens responsible for the disease and the host response.

The medication used for this patient was a hydrogen peroxide gel that denatured the biofilm by cleaving the hyaluronic acid and converting alanine and asparagine to histadine and aspartate.⁸ Hydrogen peroxide inhibits Interleukin 8 mRNA to decrease the formation of Interleukin⁸, which may explain how hydrogen peroxide may suppress tissue inflammation⁹ and helps to combat the periodontal pathogens via its oxidizing potential.¹⁰ Oxygen radicals from leukocytes¹¹ overcome the body's naturally occurring antioxidants¹² at times of acute infections.¹³ Other antioxidants, such as doxycycline, can be utilized to help overcome the oxygen radical problem.¹⁴ Doxycycline can inhibit inflammatory bone responses by inhibiting the matrix metalloproteinases in a manner separate from its antibiotic activities.¹⁵

Impressions were taken for fabrication of the medical device, which were forwarded to an FDA-registered lab that fabricated the desired tray to coincide with the patient's varying conditions (Figure 3). The most severe periodontal pocket determined the scope and magnitude of the patient's disease. The frequency and duration of usage was determined by the patient's initial disease and was modified as healing occurred.

The patient wore the custom-formed tray 3 to 4 times a day for 2 weeks in accordance with the initial disease status. The method maintained the antimicrobial medications interproximally and subgingivally in the gingival sulcus or periodontal pocket for specified intervals, and the initial periodontal treatments proved successful during her kidney dialysis phase. At 2 weeks of treatment the Papilla Bleeding Index was found to decrease, and the periodontal pockets were found to be 3 mm or less. The frequency and

duration of usage were modified as healing occurred, and long-term home care was once or twice a day. Regular re-evaluations were taken to monitor the patient's health and to ensure the patient was able to adequately manage her periodontal problems as her renal disease progressed to renal failure and eventually a kidney transplant with antirejection medications. Many antirejection drugs, such as prednisone, will decrease bone formation. Tacrolimus and cyclosporine affect bone formation, decrease calcium absorption from the gastrointestinal tract, and increase kidney calcium loss.¹⁶⁻¹⁷ In addition it is common for many of these medications to cause an increased gingival overgrowth or hypertrophy.¹⁸ The possible gingival hypertrophy did not occur, and the patient was able to manage her periodontal conditions long-term with the method described, using it daily to modify the biofilm and control the pathogens.¹⁹

RESULTS



Figure 3. Perio Protect Trays were fabricated by an FDA-registered lab for the patient for the maxillary and mandibular arches. The patient wore the trays 4 times/day for the first 2 weeks, and the frequency and duration was decreased as healing became evident. Eventually the patient wore the trays twice/day as the disease was managed. The home care usage involved the use of the tray once to 2 times/day for the next 4 years, 11 months.



Figure 4. The periodontal conditions were re-evaluated at 4 years, 11 months. There was one bleeding site (Grade 1 Papilla Bleeding Index) upon probing and no periodontal pockets beyond normal expected values of 1 to 3 mm.

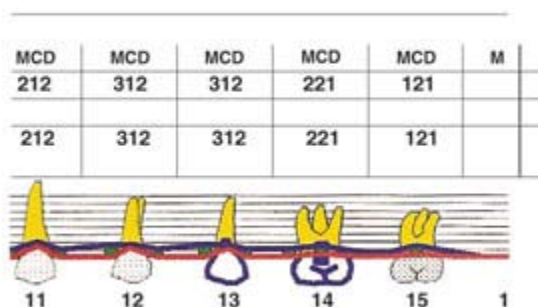


Figure 5. Periodontal probing depths at 4 years, 11 months demonstrate a significant long-term improvement. The medications inhibit osteoclastic activity,²⁰ abrogate the formation of new osteoclasts,²¹ and foster osteoblastic bone regeneration.²² The 4- and 5-mm pockets are within normal limits and the attachment level is at or near normal.

Although the patient's kidney disease continued to deteriorate to eventual renal failure, the immediate results of direct medication application were obvious by 2 weeks of treatment. The periodontal pocket depth analysis demonstrated the 5-mm pockets had all decreased to 3 mm or less, and the Papilla Bleeding Index had also decreased to almost normal (one bleeding site). The treatments for the kidney disease became more involved over time and eventually involved a kidney transplant and the usage of antirejection medications, yet the periodontal disease remained under control and no adverse gingival changes occurred from the antirejection medications.

During the onset of the periodontal disease, conventional scaling, root planing, and prophylaxis did not manage the patient's

deteriorating periodontal conditions. Although the patient was initially diagnosed with gingivitis (Papilla Bleeding Index), these periodontal conditions were found to deteriorate as her renal conditions worsened. The periodontal conditions progressed to periodontitis with generalized 4- and 5-mm pockets, along with extreme bleeding upon probing (36 sites). The results speak for themselves, as all of the periodontal pockets resolved and remained under control, and there were no pocket depths outside of 3 mm at the 4-year, 11-month re-evaluation (Figures 4 and 5). The Papilla Bleeding Index went from 36 sites to 1 site; long-term results proved stable as the method was utilized as part of the patient's long-term home care regimen.

CONCLUSION

Patients with kidney disease and/or renal failure face serious complications with blood calcium levels, modifications to the PMN function, and degenerative bone processes that may not be manageable by conventional scaling and root planing. Therefore, periodontal disease is one of the common problems these patients face. This patient's systemic health and periodontal conditions deteriorated as she experienced renal failure, hemodialysis, and a kidney transplant with antirejection medications. The patented method described in this article directed medications to the periodontal pockets that controlled the pathogens and allowed the host to heal. The method was utilized as part of the patient's long-term home care regimen, and she has been able to successfully manage her periodontal health for 4 years and 11 months.

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Dr. Keller is a general dentist practicing in St. Louis, Mo. He can be reached at drdkeller@sbcglobal.net.

Disclosure: Dr. Keller is President of Perio Protect and has a direct financial, economic, and professional interest related to this topic.

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