Powering Up Nonsurgical Periodontal Therapy in Your Practice with the KaVo Hygiene 360 System

Nonsurgical periodontal therapy is a critical component in the prevention and treatment of periodontal and periimplant disease as well as the support and maintenance of health in previously treated patients.



Given the importance of nonsurgical periodontal therapy and the various disease presentations that can require these treatments, proper disease identification, risk stratification, and optimal instrumentation is critical to achieve expected outcomes. The KaVo Hygiene 360 package, in combination with a standard dental hygiene armamentarium, can allow for a streamlined workflow and flexibility to treat a wide array of patient presentations and clinical needs.

Introduction

42.5%

be affected by destructive periodontitis

Destructive periodontitis has been found to affect approximately 42.5% of US adults.1 The primary etiology of most periodontal diseases, including gingivitis and periodontitis is bacterial plaque.² Therefore, the effective and regular removal of that bacterial plaque and any secondary plaque retentive factors, such as dental calculus, is criticalto achieving optimal periodontal health.³ The outcome of all periodontal therapy relies upon removal of the biofilm and elimination of periodontal pathogens associated with the tooth surfaces, periodontal tissues, mucosal surfaces, the tongue dorsum, and other niches within the oral cavity to achieve success.⁴ Nonsurgical periodontal therapy aims to establish a root surface that is biologically acceptable for the reestablishment of a healthy periodontal attachment.⁵

This should include oral hygiene education and improved patient-delivered plaque control, mechanical debridement of tooth surfaces, and may include the use of adjunctive antimicrobial agents during active nonsurgical therapy. While in some patients advanced surgical procedures provide an additional benefit, establishment of optimal oral hygiene and reduction of inflammation in the periodontal tissues through initial nonsurgical periodontal therapy is critical to the success of any surgical therapy.⁶ Furthermore, the long-term maintenance of the results of active periodontal therapy rely upon adequate levels of oral hygiene and consistent maintenance and examination visits with a dental professional.⁷ This report will focus on systems to improve delivery of nonsurgical periodontal therapy in the dental office to allow for optimal treatment outcomes, increased patient comfort, and ease of care for dental healthcare providers.

Pathophysiology and Prevalence for Periodontal Disease and Peri-implant Disease

Periodontal Diseases

Periodontal diseases include inflammatory diseases of the supporting structures around the teeth-the gingiva, periodontal ligament, alveolar bone, and cementum.⁸ Research shows all individuals are susceptible to gingivitis, a reversible form of gingival inflammation, and may be the precursor to more serious, irreversible forms of periodontal diseases.9 Gingivitis is caused by a dysbiotic dental biofilm and, in general, gingivitis severity is related to the amount and type of bacteria that have accumulated at and around the gingival margins throughout the mouth. Additionally, the oral modifying factors for gingivitis, including local (dental biofilm retentive factors and oral dryness) and systemic factors (smoking, metabolic factors, nutritional factors, pharmacologic agents, sex steroid hormone elevation, and hematologic conditions) are contributing factors.⁹⁻¹¹ Removal of biofilm and local etiologic factors results in the reversal of gingivitis symptoms and reduces local and systemic levels of inflammatory markers in patients with gingivitis.^{2,9,11}

Periodontitis is a chronic multifactorial inflammatory disease of the hard and soft tissues supporting the teeth associated with a dysbiotic dental plague biofilm. This dysbiotic biofilm then initiates a host immuno-inflammatory response that, over time, may result in progressive destruction of the periodontal ligament and alveolar bone if not adequately resolved.^{8,12} Average progression of periodontal disease demonstrates a slow to moderate rate of disease progression with approximately 0.1mm of attachment loss and 0.2 teeth lost annually.¹³ Groups with fastest and slowest disease progression differed considerably with accelerated attachment loss associated with access to comprehensive dental care as well as local and/or systemic factors.¹³ In an updated classification system from the American Academy of Periodontitis (AAP) and European Federation of Periodontitis (EFP), individuals are classified with a Stage and Grade to characterize disease severity and risk of future disease progression.^{12,14} Periodontitis Stage is assigned as I-IV and is assessed by patients' current disease presentation, including attachment, bone, and tooth loss, and the case complexity.^{12,14}

Prevalence of Periodontitis Amoung US Adults



greater than that of diabetes mellitus



greater than that of coronary artery <u>disease</u>

Periodontitis Grade is defined as A-C and is based upon risk and evidence of the rapidity of disease progression over time.^{12,14} The prevalence of periodontitis has been estimated to be over 42% of U.S. adults over 30 years of age.¹⁵ These statistics suggest that the prevalence of periodontitis among US adults is nearly 4-fold greater than that of diabetes mellitus¹⁶ and over 6-fold greater than that of coronary artery disease.¹⁷ Periodontitis is extremely prevalent and after initiation by bacteria and bacterial virulence factors, disease progression and tissue destruction occurs through host-mediated inflammatory pathways,¹⁰ which may vary based upon genetic and other risk factors.¹⁸⁻²¹The result is a chronic immune-inflammatory disease that may pose a significant systemic burden for individuals.²²



Peri-implant Diseases

Peri-implant mucositis has been defined as an inflammatory lesion of the mucosa surrounding an implant without loss of supporting peri-implant bone.^{23,24} Peri-implant mucositis has been shown to develop when biofilm deposits accumulate within the mucosal sulci at osseointegrated dental implants.²³⁻²⁵ While these lesions have been characterized as analogous to gingivitis lesions around teeth, it has been noted that the histologic inflammatory lesions associated with peri-implant mucositis are larger and require a longer time of pristine oral hygiene to reverse than gingivitis lesions.^{26,27} The overall incidence of peri-implant mucositis has been reported to be observed in up to 65% of subjects with dental implants.²⁷ Clinical signs associated with peri-implant mucositis include bleeding upon gentle probing, erythema, edema, and suppuration.²⁵ Additionally, while peri-implant mucositis is reversible and may be present for long periods of time without progression to peri-implantitis, it is considered a precursor to peri-implantitis and may progress if left untreated.^{25,26,29}

Peri-implantitis is a pathological condition occurring in tissues around dental implants that are osseointegrated and in function, which is characterized by inflammation of the peri-implant mucosa and loss of supporting peri-implant bone.^{24,30} Clinically, these lesions are characterized by swelling, erythema, pain, bleeding upon probing, suppuration, increasing probing depths and radiographic bone loss.²⁴ Peri-implantitis lesions have been demonstrated to commence early (within three years of function) in the post-restorative period and to progress more rapidly than is seen with periodontitis lesions.^{31,32} Peri-implantitis progression occurs in a non-linear, accelerating pattern.³¹ Risk factors that have been associated with peri-implantitis include a history of periodontitis, smoking, hyperglycemia, retained cement, restorative design, implant-abutment interface, and previous implant failure at the implant site.^{30,33-37} Overall incidence of peri-implantitis varies in different reports and have been reported to range from 10-47%.27,38,39



Given the highly prevalent nature of peri-implantitis and the relative difficulty in treating peri-implant lesions, identification of high-risk patients is critical in clinical practice.

Rationale and Expected Outcomes for Nonsurgical Periodontal Therapy

Periodontal and Peri-implant diseases are infectious and inflammatory diseases initiated through exposure to virulent periodontopathogenic microorganisms present in bacterial plaque including Porphyromonas gingivalis, Agreggatibacter actinomycetemcomitans, Tannerella forsythensis, Prevotella intermedia and spirochete spp. These bacteria and their virulence factors trigger a host immunoinflammatory response in susceptible individuals resulting in local tissue destruction.^{2,5,40} Debridement of tooth surfaces to render them plaque-free and to remove plaque retentive factors, such as calculus is the primary goal of mechanical periodontal therapy.⁴⁰ Scaling and root planing (SCRP) is most often the first mode of treatment recommended for most periodontitis cases and has shown clinical benefit in sites with probing depths (PD) greater than 3mm.⁵ The probing depth reduction seen after ScRP is usually associated with 1) gingival recession after reduction in edema, 2) repair by long junctional epithelium (LJE), and 3) decreased periodontal probe penetration into the connective tissue at the base of the periodontal pocket.⁵ In addition, a decrease in overall subgingival microbes as well as a reduction in virulent species, such as spirochetes and motile rods is observed.⁴¹ Mean probing depth reduction and clinical attachment level gain associated with ScRP can be stratified by probing depth (Table 1).⁵ Additionally, ScRP has been shown to reduce bleeding upon probing (BOP) up to 80% and a reduction of the pericentage of PD 4mm by 50-80% for up to 2 years.⁴² It should be noted, however, that ScRP efficacy has limitations and complete removal of subgingival plaque and calculus may not be achieved at sites with a probing depth > 4mm.⁴³⁻⁴⁵ In these cases additional periodontal therapies may be necessary if deep probing depths persist.

Initial Probing Depth	Probing Depth Reduction	Clinical Attachment Level Gain
1-3 mm	0.03 mm	-0.34 mm
4-6 mm	1.29 mm	0.55 mm
>6 mm	2.16 mm	1.19 mm



Risk-Based Assessment for Periodontal Therapy and Maintenance

Nonsurgical therapy has been shown to reduce systemic proinflammatory cytokine levels, including IL-1, IL-8, MMPs, and TNFfollowing an initial elevation of these biomarkers immediately post-treatment.^{5,23,30} Given the medium and long-term reduction of serum proinflammatory biomarkers, investigations have evaluated the effectiveness of nonsurgical periodontal therapy in patients with systemic conditions that have an inflammatory component.^{46,47} A summary of conditions which may affect the outcomes of nonsurgical periodontal therapy can be found in Table 2.

Predictor	Level	Criteria	Long-term stability
Diabetes (HbA1c) ^{12,14,79,80}	Patient	HbA1c ≥ 9%	Unfavorable
Obesity [Body Mass Index (BMI)] ^{81,82}	Patient	BMI ≥ 30 kg/m2	Unfavorable
Smoking ^{82,83} (10 cigarettes/day)	Patient	Current smoker	Unfavorable
Oral hygiene (Plaque index) ^{82,84}	Full mouth	PI > 30%	Unfavorable
Radiographs ^{82,85}	Site	Crestal lamina dura present	Favorable
	Site	Loss of crestal bone height	Unfavorable
Bleeding upon probing (BOP) ^{82,86,87}	Site	BOP absent	Favorable
	Site	BOP present	Questionable
	Full mouth	BOP at 30% of sites	Unfavorable
Gingival Inflammation (GI) ^{82,84}	Tooth	All tooth sites GI ≤ 1	Favorable
	Tooth	All tooth sites 1< GI ≤ 2	Questionable
	Tooth	All tooth sites GI ≥ 2	Unfavorable
Probing Depth (PD) ^{82,84,85}	Site	Change in PD = 0 ± 1 mm	Favorable
	Site	Change in PD ≥ 2mm since previous visit	Unfavorable
	Full mouth	Eight of more sites with PD ≥ 5mm	Unfavorable
	Site	PD ≥ 6mm	Unfavorable



Further, data suggest that 20–30% of individuals do not respond as expected to periodontal therapy.^{48,49} Many factors may contribute to that response, such as improper removal of bacterial deposits and calculus, poor plaque control, systemic conditions leading to an impaired immune response, defective restorations, occlusal dysfunction, periodontal-endodontic involvement, smoking, and others. In these cases, other treatment approaches may be required to manage refractory or recurrent cases successfully. The challenge with managing such cases is that we cannot always identify other contributing factors or, when identified, these contributing factors may not be modifiable or properly controlled. Further, data suggest that individuals who are diagnosed with periodontitis that is classified as Stage III/IV or Grade C are more likely to experience disease progression and tooth loss due to periodontitis as well as peri-implantitis.⁵⁰⁻⁵⁵ Given these factors, identifying individuals who may require more intensive therapy, shorter periodontal maintenance intervals, and/or adjunctive medicaments or therapy to more thoroughly address high-risk patients is critical and requires a comprehensive evaluation and continual reassessment of individualized patient responses to therapy. Therefore, periodontial and peri-implant maintenance is essential for the sustainable success of nonsurgical periodontal therapy.

Periodontal Maintenance

Patients who are undergoing periodontal maintenance are generally patients with a previous diagnosis of periodontitis who have completed active periodontal therapy, surgical or nonsurgical.^{5,76,77} It is important to note that this procedure is distinct and different than a prophylaxis and can involve the select re-treatment of a small number of active periodontal pockets in a patient who has already demonstrated susceptibility to periodontitis and progressive attachment loss.^{76,77} The AAP Glossary of terms defines a periodontal maintenance procedure as, "Procedures performed at selected intervals to assist the periodontal patient in maintaining oral health. As part of periodontal therapy, an interval is established for periodic ongoing care. Maintenance procedures are under the supervision of the dentist and typically include an update of the medical and dental histories, radiographic review, extraoral and intraoral soft tissue examination, dental examination, periodontal evaluation, removal of the bacterial flora from crevicular and pocket areas, scaling and root planing where indicated, polishing of the teeth, and a review of the patient's plaque control efficacy. Periodontal maintenance procedures following active therapy is not synonymous with a prophylaxis."⁸ Given that the interval and procedures performed during periodontal maintenance will vary based upon individualized findings and the overall risk assessments for disease progression, it is important to utilize an armamentarium that is appropriate for each patient's clinical and historical presentation.⁵⁰⁻⁵⁵ When utilizing the SONICflex[™] quick 2008L sonic scaler, a combination of tips can be considered based upon the presence, extent, and depths of periodontal pockets found in a patient. Should deeper periodontal pockets be present, air polishing should be accomplished with a water-soluble polishing powder such as the PROPHYflex[™] Perio (glycine) or PROPHYflex[™] (sodium bicarbonate) powders.

Peri-implant Maintenance

The importance of peri-implant maintenance is wellestablished to reduce the risk of peri-implant complications and regular implant maintenance has been shown to reduce the overall economic burden associated with treatment of biologic implant complications.^{29,30,37,78} The KaVo Hygiene 360 system is designed to consider the unique morphology of dental implants and their increasing prevalence within dental practices and to provide targeted instrumentation for nonsurgical peri-implant care. Utilization of implant-specific tips with a PEEK surface to reduce scratching of titanium fixtures and/or galvanic reactions can allow for optimal removal of soft and hard deposits without significant damage to implant components. Such powered instrumentation should be paired with implant specific manual curettes to reduce risk of damage to implant and abutment surfaces.

Keno

KANO

Kavo Hygiene 360 Products for Nonsurgical Periodontal Therapy

KaVo Hygiene 360 suite of products offers the ability to move through a hygiene appointment for a periodontitis patient and supports periodontal maintenance as well as prophylaxis. It has been long established that all individuals are susceptible to development of gingivitis in the presence of bacterial plaque and that such cases of dental plaque biofilm induced gingivitis are reversible.^{2,75} A prophylaxis procedure, therefore, is aimed at preventing gingivitis or creating an environment in which, with adequate oral home care, gingivitis can be reversed. An oral prophylaxis is defined as, "The removal of plaque, calculus, and stains from the exposed and unexposed surfaces of the teeth by scaling and polishing as a preventive measure for the control of local irritational factors."8 Because this procedure is preventative in nature, it should be performed in the absence of deep periodontal pockets and, therefore, a slightly different armamentarium may be necessary that used for scaling and root planing procedures.



Prophylaxis

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KaVo SONICflex[™] Series Scalers

The initial removal of calculus deposits and biofilm both supra and subgingivally is critical to create an environment that is conducive to facilitating patient home care delivery and periodontal health.⁴⁰ With over 50 SONICflex[™] tips, they can adapt for myriad clinical scenarios and allow for access into deep periodontal pockets, furcation entrances and to clean restorative surfaces without damaging the materials. The SONICflex[™] connects to the KaVo MULTIflex coupler and does not require use of a foot control. The use of a powered scaler can reduce the amount of residual calculus, bacterial biofilm, and reduce overall treatment time for patient.⁵⁶⁻⁵⁸ Further, use of sonic scalers may result in less root surface roughness when compared to ultrasonic scalers,⁵⁹ which could potentially result in decreased biofilm adherence after therapy.



Scaling and Root Planing

In patients with periodontitis, scaling and root planing is often required as either the definitive treatment for mild disease and/or as initial therapy prior to phase II surgical treatment in patients with moderate to severe periodontitis.^{5,74} Scaling is defined by the AAP's glossary of terms as, "Instrumentation of the crown and root surfaces of the teeth to remove plaque, calculus, and stains from these surfaces" while root planing is described as, "A treatment procedure designed to remove cementum or surface dentin that is rough, impregnated with calculus, or contaminated with toxins or microorganisms."8 Given the goals to accomplish removal of both the etiologic factors on the teeth and the preparation of root surfaces to reduce plaque and calculus adherence, access to subgingival surfaces at sites of pathologic periodontal pockets is critical. Utilization of a powered sonic scaler like the SONICflex™ scaler with "perio" and "root planer" scaler tips designed for periodontal sites with manual instrumentation with curettes. particularly those designed for deeper periodontal pockets, can allow for the high levels of efficiency, ergonomics and access into such periodontal pockets.⁵⁶⁻⁵⁹ Subgingival instrumentation is a technique-sensitive procedure and the success of debridement is dependent upon the severity of the initial defect, operator skill, time spent during the debridement, and the types of instruments used during the debridement.^{5,56} While studies indicate that similar end points may be reached using manual or sonic and/or ultrasonic scalers, the time spent during manual debridement can be up to 50% longer than with the use of powered scalers.^{57,58} Furthermore, calculus removal efficiency decreases as pocket depth increases, 44-46 but the use of modified ultrasonic tips may improve calculus removal at deep pockets.56 It has been suggested that the use of power-driven scalers in combination with manual debridement may produce the best overall result for ScRP.^{5,56} The Kavo Hygiene 360 suite of products offers the ability to move through a hygiene appointment for a periodontitis patient. Further, utilization of the PROPHYflex[™] 4 air polisher with a glycine powder designed for safe use subgingivally can aid in an antimicrobial environment within the pocket and the creation of the hard, smooth root surface after root planing.^{60,61}



An air polisher provides an alternative method of removing supragingival extrinsic stain and deposits from the teeth. Unlike conventional mechanical polishing (handpiece with rubber-cup and prophylaxis paste) used to polish teeth, an air polisher uses a light handpiece to generate a slurry of pressurized air, abrasive powder and water to remove plaque biofilm and stains.⁶⁰ The advantages of air polishing when compared to rubber-cup polishing include less time, less operator fatigue, and more efficient stain removal.⁶¹ The PROPHYflex[™] system can be paired with PROPHYpearls[™] cleaning powder, which contain a gentle microsphere technology designed for low abrasiveness with a spherical shape. Further, the calcium carbonate powder in PROPHYpearls[™] increases oral pH. This elevated pH can reduce caries rates and reduce dysbiotic bacteria.⁶²



Additionally, PROPHYpearls[™] come in a variety of flavors, including orange, mint, peach, and black currant to account for patient preference. The PROPHYflex[™] system also provides water-soluble powders that can be used in specific areas. The PROPHYflex[™] Perio powder is a glycine cleaning powder designed for deeper periodontal pockets and/or peri-implant debridement for use subgingivally⁶³⁻⁶⁸ and the PROPHYflex[™] powder is a sodium bicarbonate powder allowing for thorough cleaning.



KaVo PROPHYwiz[™]/SMARTmatic[™]

In addition to air polishing, the use of low-speed polishing for stain removal and hygiene polishing can target specific areas. The PROPHYwiz™ is a lightweight, ergonomic handpiece that allows for easy attachment of a prophy cup for use in tooth polishing. The SMARTmatic[™] low-speed hygiene handpieces work with an air turbine engine and allow smooth working for dental hygiene up to 20,000 rpm. These low-speed polishing handpieces can be used with standard prophy paste.



KaVo DIAGNOdent™ Pen Caries Detector

Visual examination and caries detection with a detector demonstrate sensitivity and specificity of 62% and 84%, respectively. This can lead to an undertreatment of carious lesions and the restorations of sound tooth structure.⁶⁹ The DIAGNOdent[™] Pen caries detector uses a 655 nm diode laser to detect fluorescence to aid in caries detection. This allows for detection of noncavitated, occlusal pit-and-fissure tooth decay, in addition to the detection of smooth surface caries at earlier time points than with visual inspection.⁷⁰ The DIAGNOdent[™] Pen 1measures laser fluorescence within the mineral structure of the tooth. As the incident laser light is disseminated into the site, two-way handpiece optics allows the unit to simultaneously quantify the reflected laser light energy.⁷¹ Early caries detection can allow for remineralization at sites without cavitation, but the use of an explorer can cause cavitation and reduce the likelihood of remineralization and/or minimally invasive treatment.⁷²



Recommendations for treatment are:

Values between 10–15 require no active care or treatment

Values between 15–30 require preventative or operative care.

depending on the patient's caries risk

Values of 30+ require operative and preventative care.⁷¹



25 states allow for the use of lasers for diagnostic purposes by registered dental hygienists



Another 18 states are silent on this issue



7 states explicitly prohibit laser use by dental hygienists.⁷³

It is important to understand your local regulations on the use of any technology in dental practice.

Clinical Scenarios for KaVo Hygiene 360 Products

Nonsurgical therapy encompasses a wide array of preventative and therapeutic treatments provided within the dental office.⁵ While all of these procedures differ in their scope and underlying purpose, many of the components of care delivery are similar and the KaVo Hygiene 360 products can allow a dental healthcare practitioner to seamlessly move from one to another while also providing personalized care for each individual patient based upon his/her clinical presentation, history of treatment, and diagnosis(es).⁵⁰⁻⁵⁵ It is also important to note that comprehensive examination, risk assessment, oral cancer screening, and caries detection is a critical component of overall oral wellness and these procedures should be performed for all patients.^{69,70}

Modern dental hygiene encompasses a wide swath of nonsurgical periodontal care within the dental office, including: data collection, risk assessment, disease identification, patient counseling for behavior modification, preventative care, and active therapy.^{5,74} Because of the broad range of procedures and disease presentations that dental hygienists encounter within their practice on a regular basis, it is imperative that the equipment with which they are working provides them the capability to accomplish all of their procedures efficiently and effectively. Furthermore, ergonomics, sterility, and portability within the dental office can allow for cross-utilization of equipment and increase the overall benefits to the dental practice and dental patients. The KaVo Hygiene 360 package allows for treatment of an array of periodontal conditions with the components in the system and is capable of modular use of all components with a small footprint and portability throughout the dental office. All components are able to be sterilized in the autoclave, resulting in peace of mind for practitioner and patients alike regarding the cleanliness within the dental office. Lastly, the lightweight, ergonomic design of the components may reduce fatigue and injury while providing a faster workflow between steps of the hygiene visit.

Conclusions

Nonsurgical periodontal therapy is a critical component to preventative, active, and supportive periodontal and peri-implant care. Given the importance of these treatments and the prevalence of periodontitis and peri-implant diseases, accurate diagnosis and risk assessment for patients is critical to provide optimal care and promote oral and overall wellness. Utilization of an armamentarium, like the KaVo Hygiene 360 product suite, that allows for delivery of nonsurgical care that is effective across a spectrum of periodontal and peri-implant conditions is a critical component to the successful treatment of patients with periodontal and peri-implant diseases by dental healthcare professionals.



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