Review Article

PERIODONTAL ENDOSCOPY: A REVIEW

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Abstract
Periodontal endoscopy, known as Perioscopy is a procedure to view the inside of the pockets between the gum and teeth at high magnifications. The instrument used is a Perioscope, the basic design of which was for diagnosis but has been adapted as an aid for treatment of periodontitis. It consists of a miniature camera protected by a clear sleeve which is then inserted into the gingival sulcus or pocket for subgingival visualization and instrumentation. The images generated can be viewed in 24x to 48x magnification on a chair side monitor and hence can disclose even minute details of root pathologies. The Perioscope, thus providing excellent visualization of the subgingival surfaces can aid in complete removal of subgingival plaque, calculus and bacterial infections and provide an excellent conservative approach to Surgical and Non surgical periodontal care.
Key words: Perioscopy, periodontal endoscopy, minimally invasive procedures, periodontitis

INTRODUCTION

Periodontal Therapy is defined as the treatment of periodontal diseases aimed at arresting or reversing their progression. This therapy is based on the concept of removing calculus depositions and plaque biofilms by manual or ultrasonic instruments from the root surfaces and tooth surfaces. It utilizes procedures using indirect tactile sensations in closed pockets or direct visualizing of the surfaces by flap surgeries. Effect of these procedures was modified by various factors including morphology of the root, extent of the defect, subgingival access and the skills of the treating periodontist.

It was observed by Brayer et al and Sherman et al that mechanical debridement using manual techniques did not ensure complete removal of root deposits and some residue remained after treatment. [1, 2] Therefore it was believed that using magnification may improve the visualization of the roots and hence improve the quality of therapy.

Latest developments and improvements in the field of fibreoptics has resulted in the development of miniature fibreoptic devices that allow the periodontist to visualize the subgingival area hence allowing the examination of the hard and soft subgingival tissues non invasively.

This latest microdentistry concept, a miniature endoscope called the Perioscope has been developed which is designed to enter the most inaccessible pockets with minimal trauma to diagnose and treat periodontal diseases. This technique utilizes a miniature endoscope paired with enhanced lighting, video streaming and magnifications to view sub gingival areas conservatively.[3] Thus this device can offer a magnified and a very clear view of the root and inaccessible areas like furcations, subgingival calculus, sulcular epithelium, cemental tears and perforations and pathways of draining sinuses.

THE PERIOSCOPE

The Periodontal endoscope; Perioscope is manufactured by DentalView Inc., Lake Forest, CA, USA.

Perioscope consists of four parts

1. Perioscopy unit,
2. Perioscopy explorers,
3. Perioscopy sheaths,
4. Perioscopy fiber.

The word endoscope is derived from the Greek words ‘endo’ and ‘skpoeein’ meaning ‘inside’ and ‘to see’ respectively. Thus the perioscope allows for visualization of root surfaces subgingivally under magnification of 24x to 48x.

The Perioscope has a flexible design and can be easily used in conjunction with other periodontal instruments. The use of this instrument has been described by Avradopoulos et al in 2004 and Stambaugh in 2002 as a non invasive method for examination of hard and soft tissues subgingivally and allows direct view of the area. [3, 4]

The major advantage this instrument has over other magnifying devices ie Loupes and Microscopes is the intimate connection with the root surface which keeps the image within the focal depth and hence the image remains

stable and there is no distortion even during movement. Therefore the Periscope stands out as the only minimally invasive real-time video based treatment modality for periodontal diseases.

The parts of the Perioscope are:
The Fiber-Optic Strand: It is the basic component comprising of 10,000 individual light guiding fibers fused into a 2mm long, 0.5mm diameter strand at the end of which is a gradient index lens. Around the bundle are 15 large core fiber optic strands used for carrying illumination to the operating site. The whole assembly is encased in flexible plastic tubing with a spring activated connector imm from the distal end and optical connectors for image and light at the other end.

The Sterile Sheath: The fiber optic strand is enclosed in a disposable sheath with a sapphire window for clear viewing. The sheath is sterlised and can be disposed after every patient. This sheath not only maintains the sterility of the viewing field but also aids in maintaining the lifespan of the fiber optic strands as the strand comes in contact with the infectious subgingival tissues of the periodontitis patient and it becomes mandatory to sterlise the cord, with repeated sterlisations the lifespan of the fiber optic cable reduces ie the strands last for only 12 sterlisation cycles. This becomes time consuming, expensive and impractical which the presence of the sheath solves as it provides an efficient barrier against contamination as well as increases efficiency.

The Peristaltic Pump: To keep the viewing field clean a peristaltic pump has been incorporated which keeps up a constant pulsatile irrigating water spray under the fiber optic strand and also around the strand with the help of a separate water channel in the sheath. This allows for a clean viewing field, free from blood and debris which is expected of the highly inflamed periodontal tissues which may obstruct the view.
The CCD Camera: The sapphire lens at the end of the fibre optic strand can be focused on the tooth surface and sends the image captured through the fiber optic strands to the image/video sensing camera. This medical grade camera with a camera coupler has a CCD sensor which acts as the film of the camera and converts the image into digital signals which are sent to the camera control unit. The signals are the converted to S-video output and can be viewed on a LCD/TFT monitor. The lens is very versatile with a 70º view in air and 53º view under water and suboptimal conditions. The images thus received are clear and can be magnified up to 24x - 48x.

The Micro-Surgical Instruments: Instruments like explorers, curettes, ultrasonic scalers have been modified and developed for use with the Perioscope. All the instruments have a retractor added to help in gingival retraction for an unobstructed view. The curette has a soft tissue shield on the blade to act as a tissue retractor to hold the tissue away from the endoscope and give a clear view of the blade and the tooth surface. A stainless steel ultrasonic adapter comprising of a collar and strut attaches to the standard ultarasonic scaler unit with a screw andtube which has a distal tip shaped for gingival retraction and is placed next to the tip and perioscope. The explorer doubles as a periodontal probe and has a stainless steel tube attachment for the endoscope with a distal tip modification for gingival tissue retraction. [5]

INDICATIONS FOR PERIO-SCOPE

- Initial periodontal therapy for patients having > 4mm probing depths.
- Magnified view of root surfaces for better debridement of subgingival calculus using specialized microsurgical instruments.
- Periodontal sites that do not respond to nonsurgical debridement.
- Visualisation and restoration of aberrant anatomical root variations and malformations.
- The technique can avoid the detrimental sequelae of recession and root exposures of periodontal flap surgery.
- This procedure can aid in the treatment of cases with increasing pocket depths, Refractory periodontitis and chronically inflamed pockets.
- This technique can aid in the management of teeth with poor prognosis or less access to defects with minimal inavasive instrumentation.
- Implant mucositis and peri-implantitis can be resolved early by visualization and debridement hence avoiding a second surgical procedure.
- Perioscopy can help patients with systemic conditions were surgery is contraindicated. [6]
- Perioscope can aid in the usage of minimally invasive procedures thereby reducing trauma and enhancing healing.

PERIO-SCOPY PROCEDURE:

The endoscopic procedure using the Perioscope is a patient conducive procedure with minimal discomfort and can done in majority of patients without the use of local anaesthesia. In this procedure the periodontist holds the perioscope in the nonworking hand while using the micro tools for debridement with the working hand. The whole process is less detrimental to the root surface as the clinician can easily visualize the deposits and does not have to rely on tactile sensations. The monitor gives a magnified image of 24x – 48x of the working area and nearly 3mm of the area can be visualized at one time. The whole procedure for the treatment of full mouth is 90 – 120 min in the hands of an expert clinician.

ADVANTAGES OF PERIOSCOPY

- The periodontist is able to view the subgingival root and tissue morphology and can assess the status and accurately diagnose conditions and better manage them by the least invasive method.
- Loss of image quality under magnification is minimal allowing a periodontist to accurately visualize root surfaces and provide efficient instrumentation thus avoiding over instrumentation and its sequelae of loss of cementum or sensitivity.
- The perioscope enables a clinician to spot any gingival pathology which may affect treatment at the earliest.
- The periodontist can easily identify any root malformations or anatomic aberrations which might affect maintenance of periodontal health.

DISADVANTAGES OF PERIOSCOPY:

- The Perioscope is a revolutionary product but the procedure is time consuming and comparable to time taken for a conventional periodontal treatment.
- Even though the procedure causes minimal discomfort, majority of patients not needing local anesthesia, some patients may need local anesthesia similar to periodontal surgical procedures.
- The use of the Perioscope requires additional training and time for competency and proficiency as it requires a different set of clinical skills.

PERIOSCOPY IN PERIODONTAL DISEASE

A scanning electromicroscopy study in 1973 by Armitage and Christie reported the presence of cemental abnormalities at the cement dentinal junction in cases of unresolved and aggressive periodontitis. [7] This was revisited in 1999 by Yammaamato who added that the entire length of the diseased root surfaces have resorption lacunae. [8] The studies indicate a refractory nature of periodontal diseases and the management of such patients may become easier with the use of the Perioscope. [9] A study was done in 2007 by Mellonig and Geisinger to compare the use of perio endoscope in SRP and SRP alone and concluded that SRP with endoscopy resulted in a statistically significant decrease in residual calculus as compared with SRP alone. [10] An addition to this study was done by Michaud and Mealey in 2007 on multi rooted teeth and they reported a reduction in residual calculus in shallower pockets of ≤6 mm but the overall use did not show any significant improvement over SRP alone. [11]

A histological study was undertaken by Wilson and Carnio in 2008 on the effect of removal of biofilm and calculus with the dental endoscope and they concluded that bone repair and healing with a long JE was observable on treated root surfaces and absence of histological signs of inflammation 6 months after single treatment. [12] In 2004 a study was conducted by Avradopoulos et al to compare changes in pocket depth and inflammatory marker PGE_2 in sites treated with SRP alone and using a Perioscope which concluded that there were no statistically significant variations in the two sites. [13] Christine M in 2013 did a randomized split mouth study to determine if the use of a periodontal endoscope improved periodontal outcomes of SRP and reported that the use of the perioscope improved periodontal outcomes with respect to gingival inflammation and BOP but did not find it to be superior to traditional scaling and root planing with regard to pocket depth reduction and clinical attachment loss.[14]

In 2006 Caroll J reported a procedure with good results which he called RPE (Regenerative Periodontal Endoscopy) in which Sub microbial doses of Doxycycline ie Periostat were used to control pre-treatment inflammation, the Perioscope was used for effective subgingval deposit removal and Emdogain(EMD) was used to stabilize and regenerate bone.[15]

Perioscopy has shown to have many advantages but more clinical studies are needed before it can be effectively used as a frontline periodontal therapeutic option.

CONCLUSION

The goals of periodontal therapy are attainable if we are able to visualize the affected areas before, during and after manual or mechanical therapy and also easily visualize hard to reach areas like furcations. A device that can make this possible would be a valuable noninvasive diagnostic tool.

With advances in optical technologies, visualizations of the internal workings of the human body have become possible. One of the important developments was the Endoscope which has been used widely in the diagnosis, assessment of disease and subsequent avoidance of surgery or other invasive procedures of the tracts of the body (Becker, 2003; Chand et al, 2003; Itzkowitz and Harpaz, 2004; Yeung and Yeung, 2003). In dentistry, the use of an endoscope has traditionally been limited to surgical procedures of the temporomandibular joint or for intracanal visualization in endodontic therapy.

In the past use of endoscopy in periodontal diseases and therapy was not possible due to technical problems. However, recent advances in fiber-optic technology, together with modifications of the micro periodontal instruments, have led to the development of an endoscopic instrument that allows non invasive direct inspection of the subgingival area, the Perioscope.

The clear advantage of this device is the non-invasive method for diagnosing subgingival root deposits, caries, root fractures and soft tissues. However, the endoscopic image interpretation is difficult as it is visible in a 2.4 – 6.6 cm diameter field and is not very bright. The magnification is good, being between 24x – 48x depending on the distance between the object and the tip of the endoscope.

The handling of the instrument is a skill acquired with constant practice as the clinician has to manage the orientation and movement of the fiber optic tip in an anatomically typical subgingival area.

In addition, original studies regarding efficacy of the Perioscope in periodontitis are few and scarce (Stambaugh, 2002; Stambaugh et al, 2002) and inconclusive (Avradopoulos et al, 2004). Therefore despite the advantages of this new technology further clinical studies are needed to accurately assess the effectiveness of the Perioscope keeping in mind the cost effectiveness and additional skills required for it. As of now, its regular use in daily practice cannot be recommended.

REFERENCES

1. Brayer WK, Mellonig JT, Dunlap RM etal: Scaling and root planing effectiveness: the effect of root surface access and operator experience. JOP 1989; 60: 67–72.
2. Sherman PR, Hutchens LH Jr, Jewson LG: The effectiveness of subgingival scaling and root planing. II. Clinical response related to residual calculus. JOP 1990; 61:9–15.
3. Kwan, J.Y. Enhanced periodontal debridement with the use of micro ultrasonic periodontal endoscopy. CDA Journal, 2005, March: 33 (3), pp. 243-244.
4. Avradopoulos V, Wilder RS, Chichester S, Offenbacher S. Clinical and Inflammatory Evaluation of Perioscopy™ on Patients with Chronic Periodontitis. Journal of Dental Hygiene. 2004 Jan 1;78(1).
5. Harrel SK, Abraham CM, Rivera-Hidalgo F, Shulman JD, Nunn ME. Videoscope-Assisted Minimally Invasive Periodontal Surgery: One-Year Outcome and Patient Morbidity. International Journal of Periodontics & Restorative Dentistry.2017 May 1;36(3).
6. Stambaugh RV, Myers G, Ebling W, Beckman B, Stambaugh K: Endoscopic visualization of the submarginal gingiva dental sulcus and tooth root surfaces. JOP 2002; 3: 374–382.
7. Armitage GC, Christie TM : Structural changes in exposed human cementum. II. Electron microscopic observations. J Periodont Res 1973;8:356–365.
8. Yamamoto T, Domon T, Takahashi S etal. The structure and function of the cemento-dentinal junction in human teeth. J Periodont Res 1999;34:264-268.
9. Bartold PM, I Ishikawa, N Vergel de Dios: Changing Trends in Periodontal Diagnosis, Disease Recognition & Management, 2004 APSP.
10. Geisinger ML, Schoolfield J, Mellonig JT etal. The Effectiveness of Subgingival Scaling and Root Planing: An Evaluation of Therapy With and Without the Use of the Periodontal Endoscope JOP January 2007, Vol. 78,No. 1, Pages 22-28.
11. Michaud RM, Schoolfield J, Mellonig JT, Mealey BL, The Efficacy of Subgingival Calculus Removal With Endoscopy-Aided Scaling and Root Planing: A Study on Multirooted Teeth JOP December 2007, Vol. 78, No. 12, Pages 2238-2245.
12. Wilson TG, Carnio J, Schenk R, Myers G: Absence of Histologic Signs of Chronic Inflammation Following Closed Subgingival Scaling and Root Planing Using the Dental Endoscope: Human Biopsies – A Pilot Study : J Perio November 2008, Vol. 79, No. 11, Pages 2036-2041.
13. Avradopoulos V, Wildre RS, Chichester S, Offenbacher S: Clinical and inflammatory evaluation of Perioscopy on patients with chronic Periodontitis. J Dent Hyg 2004; 78: 30–38.
14. Christine M.B, Patricia L, Scott L. etal A Pilot Study Comparing the Outcome of Scaling/Root Planing With and Without Perioscope

Technology. J Dent Hyg June 2013 vol. 87 no. 3 152-157.

15. Carrol, J. The evolution of care: why perioscopy could change the way you view your patients.2006, November: Modern Hygienist, pp. 46- 48.

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