Review Article

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TECHNIQUE IN CALCULUS DETECTION AND REMOVAL: A REVIEW

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ABSTRACT:

Conventional periodontal therapy is the effective removal of bacterial deposits from the root surface along with the calculus deposits. The efficacy of this treatment depends not only on different factors like the anatomy of the subgingival area and the presence of furcation defects but also on the therapist's skills. The examination of the treated sites is accomplished by manual and tactile exploration. However, tactile perception of the subgingival environment without visible access may lead to the unwanted removal of the cementum. This lead to the advent of advancement in the sphere of magnification and illumination. This has been made possible as a result of the improvement in fiber optic devices.

The endoscope remains as one of the pioneering and most promising tool to achieve this objective .The dental endoscope not only act as a diagnostic but also as a therapeutic adjunct to the various disciplines of dentistry including restorative dentistry, endodontics, Periodontics and Implantology, caries detection and a whole lot or more Periodontal endoscope improves periodontal outcomes of scaling/root planning when compared to scaling/root planning alone. This paper focuses on the latest advances in calculus detection technologies.

Keywords: Periodontal Therapy, Dental Endoscope, Calculus, Scaling.

INTRODUCTION:

Calculus can be defined as a hard concretion that forms on the teeth or dental prostheses through calcification of bacterial plaque (glossary of periodontal terms2001).Depending on the location calculus can be classified as supra gingival and subgingival [1].

Periodontal diseases affect a significant portion of the adult population. .The primary etiologic factor for these problems is associated with bacteria.Calculus has been shown to contain bacterial products that induce an inflammatory response and can perpetuate periodontal infection[2-3].Teeth with calculus show a a higher rate of tissue attachment loss than teeth without calculus. Therefore the removal of bacterial plaque and calculus removal from root surface using scaling and root planing is an essential part of periodontal therapy.

For years magnification has been used to enhance visualization within the oral cavity there by increasing the precision of periodontal treatment. Primary objective of scaling and root planing is to restore the periodontal health by completely removing

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pathogenic product that induces inflammation from periodontally involved root surfaces. The examination of the treated sites is accomplished by manual and tactile exploration[2-3]. Fiber optic technology has facilitated this increase in visual magnification and treatment precision.

Recent advanced technologies for identification of calculus includes a detection system only (a miniature endoscope, a device based on light reflection and a laser that activates the tooth surface to fluoresce) and a combined calculus detection and removal system. Conventional ultrasonic scaling technique can be improved by applying these recent findings.

FIBEROPTIC-ENDOSCOPY

The idea to modify a medical endoscope for periodontal use has to date been realized only in one device (*perioscopy*) which was introduced in the year 2000.The dental endoscope was advanced with the intention of showing image below the marginal gingiva for the diagnosis and as a aid in treatment of periodontal disease. The term endoscopy is derived from the Greek language and is literally translated as an endon (within) and scopion (to see) hence the meaning to "*see within*" [4].

Defnition (National library of medicine) Endoscopy involves passing an optical instrument through a small incision in the; or through a natural orifice and along natural body pathways; and or through an incision in the wall of a tubular structure or organ to examine or perform surgery on the inferior part of the body [5].

The field of endoscopy has currently expanded more within the introduction of the dental endoscope. The device perioscopy was developed in 1999 with in an irrigation system to view the periodontal sulcus after root scaling.

Fiber optic endoscope (*perioscope*) contains bundles of thin glass fibers that uses the principle of total internal reflection to transmit light to and from the organ being viewed and to transmit almost 100% of the light entering one end to the other end. The fibers are made of a special glass and each fiber is coated with a layer of glass with a different refractive index .The orientation of the fibers in a bundle used for endoscopy must be "coherent" in spatial orientation for its full length [10] (Figure 1)

MAGNIFICATION

The periodontal endoscope allows for subgingival visualization of the root surface and magnification of 24 x to 48x. This is accomplished through a .99mm fiber optic bundle that is a combination of a 10,000 pixel capture bundle surrounded by multiple illumination fibers. The objective lens of the endoscope has a nominal 70 degree field view in air. Under water this field is decreased due to the refraction index of water: 70 degree/1.33=53 degree (Figure 2).

ADAPTED INSTRUMENTS

Fiberoptic endoscope instruments including *curettes, explorer,* and an *adapter for*

ultrasonic scalers have been designed to accept the imaging system.

Curettes: A gingival retractor (soft tissue shield) was added to the blade of the curette. This retractor holds the gingival tissue away from the tip of the endoscope, providing a clear view of the curette blade and adjacent tooth surface. The curette handle was modified with a longitudinal slot and clip.

Explorer: The explorer /probe is a stainless steel tube welded to a handle. This tube accepts the endoscope /window sheath. The distal tip was shaped to provide a gingival retractor. The tube also directs irrigation fluid delivered by the attached endoscope /window sheath.

Ultrasonic adapter: Stainless steel is a single unit comprising a collar, a strut and a tube. Collar fits in to the end of a standard ultrasonic scaler and locked in position. The tube is positioned alongside the scaler tip and the window sheath. The distal tip of tube is shaped to provide retraction of the gingival tissue. The tube also directs irrigation fluids.

Endoscope sheath: Sterilization is essential if the distal tip of the perioscope comes in direct contact with the patient tissue. As sterilization is either time consuming or reduces the expected instrument lifetime, a disposable sheath that can be quickly and easily inserted was developed. A sterile disposable sheath fits over the endoscope provides a barrier against pathogens. The Sheath is fitted with a window at its extreme distal end, Provides clear illumination to the working field and a clear view by the endoscope .When the instrument is placed subgingivally, a moderate amount of bleeding might occur which would obscure the field of view and render the endoscope blind. Endoscope is provided with a standard peristaltic pump for delivery of irrigation fluid via the window sheath to the attached instrument. This is carried to the distal end where it sprays out and clear the view field (Figure 3) .

VISUALIZATION:

The endoscope is attached to a medical grade CCD video camera coupler. The camera coupler magnifies and focuses the image that is transmitted by the endoscope on to the CCD image sensor of the camera. In CCD camera the light is converted to electrical signals and these signals are transmitted to the camera control unit which digitizes the signal and applies various processing signals. The digitized signal is converted to standard video signals transferred to an attached monitor (Figure 4).

COMBINED DETECTION AND TREATMENT DEVICE

Ultrasonic tecnology-Perioscan Tm: Conventional piezo-driven ultra sonic scaler Perioscan Tm can differentiate between the calculus and healthy root surface. It also has a treatment modality that can be used to remove these calculus deposits easily .Calculus can be removed just by switching the detection mode to removal mode. Working principle of perioscan Tm is a ultrasonic device that works on the acoustic principle. Tip of the ultrasonic insert is

oscillating continuously. Hardness of the tooth surface differs from the hardness of calculus. According to the hardness of the surface different voltages are produced due to changes in oscillations. This instrument is used in two different modes. Whenever ultrasonic tip touches the tooth surface a light signal is displayed on the hand piece and on the actual unit. During calculus detection mode, the instrument shows a blue light when the calculus is present. When a healthy root surface is attained green light is displayed when the ultra sonic tip touches the healthy cementum. Various power settings aid the clinician in removing calculus.

Merits

1. Subgingival visualization of the root surface
2. Decreases chair side time –efficient scaling
3. Its miniature nature causes minimal tissue trauma
4. Avoid overzealous instrumentation
5. Non invasive method for diagnosing

Demerits

1. Calculus has to be re identified by the instruments that are used to remove it.
2. Expensive instrument.
3. Complete removal of subgingival bacterial biofilim and calculus remain a challenge.

CONCLUSION:

Numerous studies have been performed to access the efficacy of hand and ultrasonic instruments in removal of calculus. With the use of endoscope generally inaccessible anatomic consideration can be observed, diagnostic capabilities can be enhanced technique and planning can be improved. Such an instrument can prove to be an excellent tool in the hands of an experienced and skilled practioner it can also increase the patient compliance towards further dental treatment and aid in education and motivation of the patient.

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FIGURES:

Figure 1: Perioscopy uses a periodontal endoscope which is inserted in to the periodontal pocket to detect calculus.

Figure 2: Magnified image

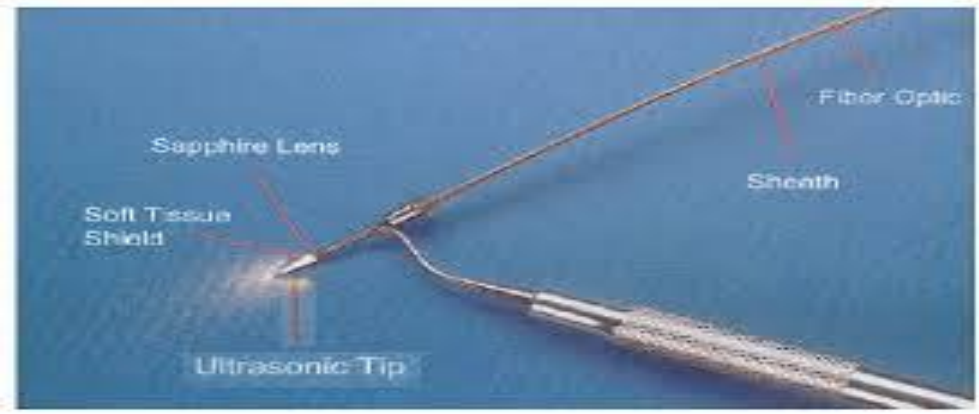

Figure 3: Dental endoscopic sheath

Figure 4: Endoscopic monitor image