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REVIEW ARTICLE

Detection, removal and prevention of calculus: Literature Review

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Abstract Dental plaque is considered to be a major etiological factor in the development of periodontal disease. Accordingly, the elimination of supra- and sub-gingival plaque and calculus is the cornerstone of periodontal therapy. Dental calculus is mineralized plaque; because it is porous, it can absorb various toxic products that can damage the periodontal tissues. Hence, calculus should be accurately detected and thoroughly removed for adequate periodontal therapy. Many techniques have been used to identify and remove calculus deposits present on the root surface. The purpose of this review was to compile the various methods and their advantages for the detection and removal of calculus.

Contents

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1. Introduction

Bacterial plaque and calculus are accepted etiological agents in the initiation and progression of periodontal disease (Ash et al., 1964). Their accumulation and attachment are facilitated by a roughened root surface (Zander, 1953; Waerhaug, 1956; Mamoru et al., 2004). The rough calculus surface may not, in itself, induce inflammation in the adjacent periodontal tissues, but may serve as an ideal substrate for subgingival microbial colonization (Jepsen et al., 2011).

Cause-related anti-infective therapy aims to eliminate the microbial biofilm and calcified deposits from diseased root surfaces through root surface debridement (Jepsen et al., 2011). Because of its porous nature, calculus can adsorb a range of toxic products and retain substantial levels of endotoxin that can damage the periodontal tissues. These toxins are found on, but not within, the periodontally diseased root surfaces; hence, the surfaces should be treated carefully without extensive removal of the underlying cementum (Nyman et al., 1986).

Current subgingival root debridement techniques involve the systematic treatment of all diseased root surfaces by hand, sonic, and/or ultrasonic instruments. This step is followed by tactile perception with a periodontal probe, explorer, or curette, until the root surface feels smooth and clean. The drawback of traditional tactile perception of the subgingival environment is that the clinician may lack visibility and accessibility before and after treatment, leading to residual calculus and/or the undesirable removal of cementum. The location and inflammatory status of the gingiva also impact the detection and subsequent removal of deep-seated calculus.

Clinicians are frequently uncertain about the nature of a subgingival root surface while performing periodontal instrumentation. Correct evaluation of a cleaned surface is a key to thorough debridement. To enhance treatment planning and efficacy, several systems for calculus detection and/or elimination have been developed, based on different technologies (Meissner and Kocher, 2011; Bhusari et al., 2013). Numerous in vivo and in vitro clinical studies have been performed to determine their efficacy of calculus removal.

2. Calculus detection systems

2.1. Perioscopy

Currently, perioscopy is the only available method for detecting calculus (Perioscopy Inc., Oakland, CA, USA). Based on the principle of medical endoscopy, perioscopy is a minimally invasive approach that was introduced in the year 2000. The perioscope is a miniature periodontal endoscope. When inserted into the periodontal pocket, it images the subgingival root surface, tooth surface, and calculus (Figs. 1a and b). Components of the perioscope include fiber-optic bundles bound by multiple illumination fibers, a light source, and an irrigation system. Perioscopic images can be viewed on a monitor in real time, captured, and saved in computer files. Although it causes minimal tissue trauma, perioscopy is not widely used, owing to its high cost and the need for a rigorous training period prior to use.

2.2. Optical spectrometry

The Detec-Tar (Dentsply Professional, York, PA, USA) calculus detection device utilizes light-emitting diode and fiber-optic technologies. An optical fiber in the device recognizes the characteristic spectral signals of calculus caused by the absorption, reflection, and diffraction of red light (Kasaj et al., 2008). Advantages of the device include its portability and emission of audible and luminous signals upon calculus detection.

2.3. Autofluorescence-based technology

Calculus contains various non-metals and metals, such as porphyrins and chromatophores. Due to their differences in

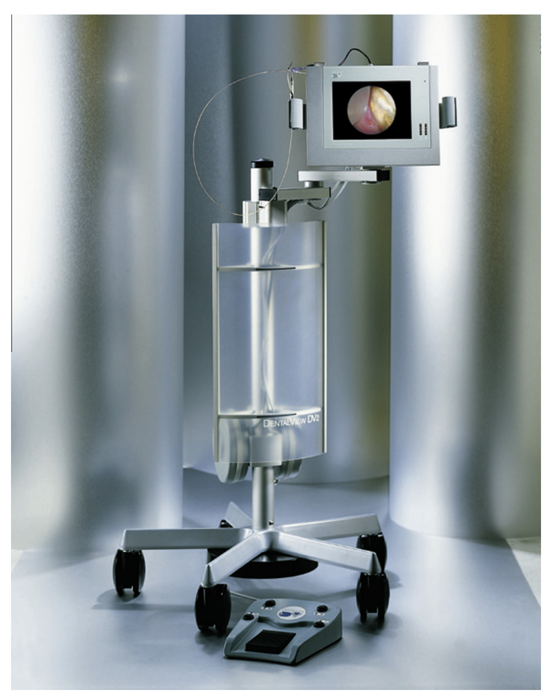

Figure 1a Perioscopy system.