



Dental Operating Microscope in Periodontics

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ABSTRACT

Most exciting innovation yet sparsely seen in private dental clinics/practitioners utilizing it. Microsurgery refers to a surgical procedure performed under a microscope. It is a practice that embraces three distinct values. First is enhancement of motor skills to improve surgical ability. This is evident in the smooth hand movements accomplished with increased precision and reduced tremor. Second is the decreased tissue trauma at the surgical site, which is apparent in the use of small instruments and a reduced surgical field. Third is the application of microsurgical principles to achieve passive and primary wound closure.

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INTRODUCTION

Most exciting innovation yet sparsely seen in private dental clinics/practitioners utilizing it. Microsurgery refers to a surgical procedure performed under a microscope. It is a practice that embraces three distinct values. First is enhancement of motor skills to improve surgical ability. This is evident in the smooth hand movements accomplished with increased precision and reduced tremor. Second is the decreased tissue trauma at the surgical site, which is apparent in the use of small instruments and a reduced surgical field. Third is the application of microsurgical principles to achieve passive and primary wound closure.

History

Almost 100 years ago, in the year 1922, Carl Nysten's ground-breaking work came to light by using a surgical microscope for an operation on a patient suffering from chronic otitis. He was rightly named the father of microsurgery [1]. In the 1950s, almost 30 years later Exploration of the scope of the operating microscope led Carl Zeiss Company to manufacture a microscope with built-in coaxial illumination that is still in use for cervical screening of the cervix and visual examination of the eardrums [2]. The clinical application increased and encompassed other medical branches such as ophthalmology, vascular, neurology, orthopedics, and many more [3].

The specialty of dentistry was late to join the operating microscope bandwagon. Early pieces of evidence show the Greenough microscope being utilized in 1949 by Van Leeuwen a dentist to study the periodontium[4].GJ Jako utilized a microscope for oral procedures such as parotid duct and carcinoma-affected tongue[5].

Nevertheless, in 1978, the Joint effort of Harvey Apotheker and Geza J Jako led to the development of the Dental Operating Microscope for its use in microscopic Dentistry [6-7]. This development led to the first commercially available dental operating microscope named Dentiscope by Chayes-Virginia Inc. for which they organized a clinical hands-on course in 1982. A tepid response was seen however its clinical significance became quite evident for endodontic procedures. The spiked interest among endodontists in the subsequent years led to the first symposium being held in year 1993 and within the span of 5 years it became mandatory for those pursuing advanced Endodontics programs in the US dental schools and its use in surgical and non-surgical endodontic be taught in all graduate programs as well[8].

Odontology dentistry under a microscope began to appear in the literature around the 1970s and 1980s [9-10]. Although slowly but its further application and scope increased from here. The branch of Periodontology got introduced to Microscopes by Shanellec DA and Tibbetts in the year 1992 and by the next year, they had discussed and presented a continuing education program on Periodontal microsurgery at the American Academy of Periodontology annual meet [11].

Minimally invasive dentistry introduced the concept of achieving positive treatment outcomes with minimal trauma and maximum preservation of dental hard and soft tissue structures which was rarely

seen earlier. The concept of minimally invasive surgery in Periodontology was made known by Harrel and Rees in 1995[12]. Dental Operating Microscope (DOM) is one such magnification tool that helps us achieve this ultimate goal. Using operating microscopes and microsurgical tools, explored to improve magnification and visual acuity with less surgical damage resulting in fewer incisions and little flap reflection for better post-surgical healing [13].

The "microsurgical triad" refers to the operating microscope's three clear benefits of illumination, magnification, and enhanced precision in the performance of surgical tasks[14]. The microscope offers 4x-40x magnification for stereoscopic vision as well as increased working area illumination. Several crucial parts make up a surgical microscope: an optical part, a supporting structure, a lighting unit, a binocular tube, and an eyepiece [15].

The Greenough type of operating microscope comprises two monocular microscopes placed side by side and angled in such a way that the two objectives can focus on the same object. This sort of microscope causes eye strain and tiredness when used for extended periods of time. Thus, the Galilean-type microscope was created and is now most commonly employed, which combines magnifying loupes with a binocular viewing mechanism, thus minimizing fatigue [16].

CLINICAL APPLICATION IN PERIODONTICS

The use of operating Microscope enhances both surgical and non-surgical periodontal therapy. Satisfactory therapeutic results lead to its wide application in the branch of periodontics.

1. Scaling and Root Planning

Basic periodontal treatment emphasizes the role of properly done root surface debridement in the outcome of periodontal therapy. The improvised illumination provided via the Dental operating Microscope plays an important role to treat hard to reach area such as furcation, groves [17]. Complete removal of physical irritants is achieved by effective instrumentation that shows clinically improved treatment outcomes as well minimal pain and discomfort to patient post the procedure [18]. The employment of micro instruments reduces the probability of over instrumentation of the sensitive root surface as well as easy to reach in difficult areas of varied tooth anatomy [19]. The importance of root debridement is recognized universally as an essential component responsible for the success of periodontal therapy. Several authors have emphasized that thoroughness of root surface debridement is the first step and most crucial for the complex periodontal surgeries followed by it. It has been reported that root instrumentation is effective when done under illumination along with an improved early healing index and less postoperative pain. This also leads to periodontitis being treated effectively by non-surgical treatment modalities then to proceed with surgical treatment options.

2. Periodontal Regeneration

The distinct advantages of dental operating microscope that is magnified vision in proper illumination has helped in maintaining the surgical procedure as atraumatic as possible. This in turn increases the probability of achieving positive alveolar bone regeneration in isolated or multiple intrabony defects. Furthermore, the competency to achieve and maintain a primary wound closure is increased as the placement of micro sutures is possible with added magnification. This surgery does not interfere with the principles of conventional periodontal regeneration surgery but only allows it to be performed with reduced trauma and providing better patient care.

3. Mucogingival surgery

Gingival recession is seen when there is apical displacement of the gingival tissue thus exposing the root surface to the external oral environment. This well protected delicate surface when exposed becomes hypersensitive and susceptible to caries, erosion. Several technique sensitive methods have been introduced to cover the gingiva which require great preciseness to achieve almost hundred percent positive treatment outcomes. This near perfection results of root coverage and gingival augmentation can be obtained by the optimal use of dental operating microscope as it overcomes the limitation associated with naked eye. It promotes better stabilization of graft, limit the invasiveness of the surgical procedure and promote healing by primary intention [20].

4. Implant treatment

Execution of treatment planning for dental implant placement cases is of utmost importance. A dental operating microscope helps with bringing clarity to the minute details of the surrounding tissues which can be overlooked by the naked eye. Dental loupes may also not achieve the same precision due to limited illumination and magnification. Implant treatment requires the clinician to have focussed vision for long hours thus increasing eye strain. This limitation is overcome by using a dental operating microscope as it is based on the Galilean type which uses binocular vision that does not require converging of eyes to focus on an object. Along with implant placement, additional procedures like sinus lift are required in certain cases which have shown a whopping success rate of 97%[21]. Technical complications like screw

breakage or loosening have also been witnessed in clinics and have been seen to be a common occurrence as the more dental implants of several systems are being placed all over the world. A case report has been published which has shown successful retrieval of abutment screws with the help of a Dental Operating Microscope [22].

5. Crown lengthening

The gingival sulcus depth and gingival margins are critical to the success of the crown lengthening procedure. When the need for osseous contouring arises, greater benefit is seen as a minimal and adequate amount of the precious alveolar bone is removed. The post-operative healing is better and inadvertent bone loss is also reduced. Although fewer studies are done on this aspect however more studies with the application of dental operating microscopes in periodontal minor surgical procedures will continue to show better treatment results [23].

6. Minimally Invasive Surgery

The aim of minimally invasive surgery is better achieved when performed under a dental operating microscope. High levels of magnification have shown premium results when combined with microsurgical instruments and illumination as compared to the use of dental loupes. Studies have shown to accomplish greater or equal periodontal tissue regeneration in medically compromised patients as compared to patients with no significant medical history [24].

FUTURE ASPECTS

Although it has been thirty years of the introduction of microsurgery into the branch of Periodontology, a lot more has to be achieved in the near and far future. Acceptance by a greater number of Periodontists at clinics, hospitals, and teaching college level is required so as to allow increased research and critical analysis. This will help in the revelation of shortcomings and also advantages specific to periodontal treatment procedures. Training should be encouraged at an undergraduate level not only theoretically but also in clinical applications. These young graduates are the future of using the dental operating microscope for its maximum advantage to the patient as well as the operator. There is work going on to synergize the third-dimension advantage with the magnified vision achieved by the dental operating microscope which will project the third dimension of the treatment target area remotely and hence avoid the need for direct visualization of the surgical field. The camera system has also been upgraded to high definition thus elevating the quality of pictures received leading to better documentation. Ergonomics is a major advantage for the clinician when using a dental operating microscope. To utilize the full potential of such a device, a rotating optical system of a dental operating microscope has been considered and thus customized for the clinician to use at different seating positions providing high-quality dental care.

CONCLUSION

Magnification-assisted periodontal procedures play a pivotal role in surgical as well as non-surgical periodontal treatment. It majorly improves visualization, overcomes the limitation of naked eye, and increases visual acuity. The healing process of the wound is much effective and faster as minimum tissue destruction is done during incision, degranulation and placement of soft tissue as well as hard tissue grafts. Furthermore, wound closure is better attained by able to use of micro sutures. Dental Operating Microscope plays an important role in training of dental graduates and post graduates in the branch of Periodontology as high-resolution photo and videos can be documented and recorded to be used for this purpose. It also greatly helps with patient education, motivation and compliance with periodontal treatment which is the ultimate goal of Periodontists all over the world.

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