Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(6), 616-622 | ISSN:2251-6727

# Videoscope-Assisted Minimally Invasive Surgery (Vmis)- An Overview

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***(Received: 16 September 2024 Revised: 11 October 2024 Accepted: 04 November 2024)***

**KEYWORDS**
Videoscope-Assisted, Invasive Surgery

**ABSTRACT:**

Periodontal therapy has been transformed by minimally invasive surgical procedures, which provide improved accuracy and shorter recovery periods. This review paper explores the use of videoscope technology in periodontal surgery, emphasizing its benefits for patient outcomes, accuracy, and visualization. The article discusses the challenges and limitations associated with employing videoscopes and provides an overview of the most recent studies on their use in periodontal therapies, such as flap operations and regenerative procedures. It also examines the integration of videoscopes into routine periodontal practice and potential directions for future research. In conclusion, this review demonstrates how videoscope technology has transformed minimally invasive surgery.

**Introduction**:

As the field of periodontology evolves, the transition from traditional invasive methods to minimally invasive techniques marks a pivotal moment. One of the most significant advancements in this transition is the integration of videoscope-assisted technology into periodontal surgery. This technology has completely revolutionized the precision of diagnosis and therapeutic effectiveness. By providing exceptional visualization and precise control during surgery, videoscope-assisted minimally invasive periodontal surgery has completely changed how treatments are approached. This holistic method has resulted in significantly reduced postoperative discomfort and

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JCHR (2024) 14(6), 616-622 | ISSN:2251-6727

quicker recovery times for patients, contrasting sharply with the extensive tissue damage and prolonged healing associated with traditional approaches[1].This review aims to elucidate the multifaceted advantages of video-assisted minimally invasive periodontal surgery, spanning from its diagnostic capabilities to its therapeutic outcomes. Furthermore, this article aims to unravel the transformative impact of videoscopes on the landscape of minimally invasive approaches in periodontics.

**Historical development of minimally invasive dentistry:**

The historical progression of Videoscope-assisted Minimally Invasive Surgery (V-MIS) began with the introduction of Minimally Invasive periodontal Surgery (MIS) by Harrel in 1995. Over the subsequent six years, further refinement and exploration of MIS were documented in several publications[2-6]

In 2007, Cortellini and Tonetti introduced a modified version of MIS, termed the Minimally Invasive Surgical Technique (MIST), that later underwent additional modifications known as the Modified Minimally Invasive Surgical Technique (M-MIST) which is used for managing intra bony defects[7]

Central to these techniques is the utilization of a videoscope, held within a device capable of retracting small flaps employed in minimally invasive procedures and has a mechanism to prevent water, blood, or other surgical waste might cause fogging or fouling of the camera lens.

A real-time image captured by the videoscope is displayed on a monitor, allowing direct visualization of root surfaces and bone within the periodontal defect. Procedures conducted with the aid of the videoscope were termed Videoscope-assisted Minimally Invasive Surgery (V-MIS). The initial description of the V-MIS procedure and preliminary results were published in 2014[6]

**Visualization techniquesused in minimally invasive procedure :**

Visualization techniques was emerged from microscope which is followed by endoscope and now it is evolved into videoscope . Initially, microscopes were used for Minimally Invasive Surgical Techniques (MIST) due to their magnification. However, issues like their bulkiness and the need to reposition them during procedures led to difficulties. The technology then evolved to endoscopes, which operate in a water-filled environment to keep the lens clear. Endoscopes also have drawbacks, such as filling the surgical site with water, which can make the procedure time-consuming. Subsequently, the technology advanced to the use of videoscopes. Today, videoscopes play a crucial role in MIST due to their ability to provide proper visualization. They incorporate small digital cameras that offer direct visualization and enhanced magnification of the surgical site. The major advantage of videoscopes is that they allow for smaller incisions, as the improved magnification reduces the need for larger openings to view the defect effectively.[9]

**Indications for videoscope in minimally invasive procedure :**

The common indications where V-MIS performed are

1)Management of interproximal vertical bony defect[10]

2)Isolated areas of bone loss withdeep probing pocket depth[10]

3) Multiple isolated interproximal defects within a single quadrant[10]

4)Minimally invasive surgical procedures wherevideoscope is employed to obtain better visualization[11]

**Contraindications for videoscope in minimally invasive procedure :**:

1)Generalized horizontal bone defects [10]

2)Multiple, interconnected vertical defects[10].

**Surgical techniques of periodontal surgery used in videoscope minimally invasive procedure**

This surgical procedure in the periodontal surgery include the following incisions, debridement, bone graft and suturing.

**Incision**

Initial incision is made within the area of bone loss, typically measuring not more than 6-8 mm mesiodistally in most of the cases. A sulcular incision is usually performed on the lingual side of the defect, running parallel to the root surface and extending to the base of the defect. Incision is placed in a way that it sever the granulation tissue alonewhile keeping the

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JCHR (2024) 14(6), 616-622 | ISSN:2251-6727

surrounding tissue intact, followed by a connecting incision. This connecting incision runs from the base of the papilla to the bone crest, aiming to preserve the periosteum on the bone. If placing the soft tissue retractor of videoscopeor if visualizing the bony defect proves challenging, a papillary incision may be made, extending apically as a split-thickness incision. A periosteal elevator must not be used to lift the periosteum from the bone, as it reduces blood supply to the periodontal tissue[6].

**Debridement**

The second step is debridement, where a significant amount of granulation tissue within the defect is removed, typically using a Younger-Goode curette. This curette works similarly to a "spoon excavator" that excavates caries from a tooth.

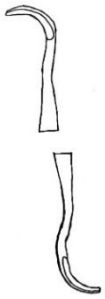

Figure1.1 Younger-Goode curette

After removing the granulation tissue, the root surfaces are debrided to eliminate accretions and roughness using a combination of ultrasonic and hand instruments. Throughout this process, the videoscope is used for visualization. While using the ultrasonic scaler, the videoscope image may become temporarily blurred due to water on the lens, but it clears quickly once the ultrasonic scaler is turned off. After mechanical debridement, the roots are dried with gauze and inspected with the videoscope[6].

**Bone Grafting**

Bone grafting is the third phase, which comes after complete root biomodification. Any bone grafting material is then gently inserted into the bony defectin a way that the defect is not overfilled as it will interfere the primary closure of the soft tissue . Wider incisionline is needed to accommodate a membrane so membranes are not used in VMIS[13]

**Suturing**

The final step in VMIS is suturing. A single vertical mattress suture is generally recommended at the base of the papilla, placed in the thick tissue to avoid postoperative recession. It is important not to place the suture in the thin tissue or directly at the connecting incision between the teeth. After placing the suture, the incision should be approximated primarily using finger pressure on a saline-soaked gauze.

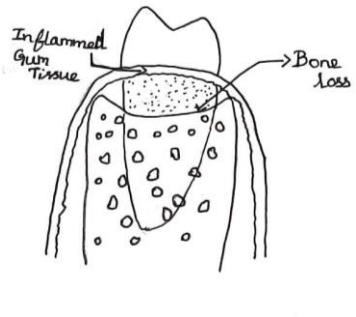


Figure1.2 (a) Inflammed tissue

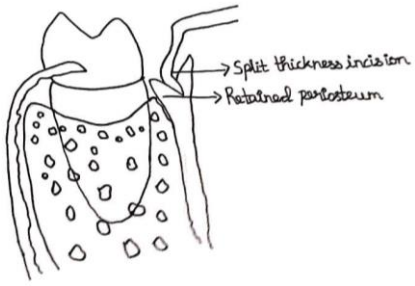


Figure 1.2 (b) Split Thickness incicion given

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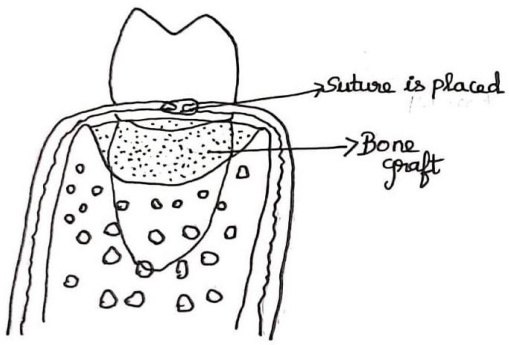


Figure 1.2(c) Bone graft placed and suture is placed

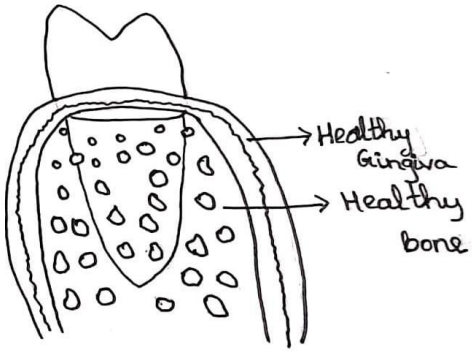


Figure 1.2 (d) Healthy gingiva

**Comparative analysis of traditional vs. videoscope-assisted procedures :**

| S.No | FACTORS | TRADITIONAL PROCEDURES | VIDEOSCOPE ASSISTED PROCEDURE |
|---|---|---|---|
| 1 | Visualization | Traditional procedure rely on direct line of sight visualization[9] | It has enhanced magnification and detailed imaging, allowing for better visualization of target area[9] |
| 2 | Precision and Accuracy | It will rely on the naked eye or less advanced imaging techniques[9] | It provides more clearer and detailed images that potentially leads to more precise interventions[9] |
| 3 | Cost | It might be more cost effective in certain settings, although the overall cost - effectiveness depends on various factors, including the specific procedure and outcomes[14] | It is more expensive due to the need for specialized equipment and training[14] |
| 4 | Recovery time | It might require larger incisions and longer recovery period[15] | It require shorter recovery time due to minimally invasive nature[15] |
| 5 | Training and Expertise | This procedure may be more accessible to health care providers without specialized training in visualization techniques[10] | This procedure typically requires specialized training and expertise to operate the equipment effectively and interpretation the images accurately[10] |
| 6 | Safety | It may carry inherent risks, which must be carefully managed by skilled healthcare providers[21] | It enhance safety by allowing for better identification of structures and minimizing the risk of accidental damage during procedure[21] |

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**Limitatons :**

Some of the limitations are

*VMIS is primarily indicated for bone loss in interproximal areas , limiting its application to specific cases[8]

* The effectiveness of the procedure may vary based on the severity and extent of periodontal disease, which can impact the outcomes.[17]

*VMIS requires specialized equipment like videoscope ,which may not be readily available in all dental settings,limiting its widespread adoption[18]

*VMIS might not be suitable for all patients, particularly those with complex periodontal conditions or contraindications to minimally invasive procedures, which limits its applicability.[19]

**Future directions and emerging trends:**

The future emerging techniques in VMIS for bone regeneration in dentistry holds exciting possibilities for the further advancements in clinical practice .Some potential future developments and trends include:

**Enhaced imaging Technology:**

Continued advancements in videoscope technology may lead to even higher resolution imaging,and improved depth perception during surgical procedures.This could enhance precision and accuracy in bone regeneration techniques

**Robotic Integration :**

Integration of robotics intoVMIS procedure could offer benefits such as increased automation, improved surgical dexterity,and potentially reduced surgical times. Robotics assistance may enchance the reproducibility and efficiency of bone regeneration .[20]

**High-definition and 3D Visualization:**
Enhanced resolution and 3D capabilities will provide even greater detail during surgery, aiding in precise navigation and treatment planning.

**Integration with Augmented Reality (AR):**

AR overlays on the monitor could highlight vital structures like nerves and blood vessels, minimizing the risk of injury

**Implant Dentistry:**
V-MIS might be used for minimally invasive implant placement, reducing surgical trauma and promoting faster osseointegration.

**Reduced Surgical Trauma:**

As technology advances, V-MIS procedures are likely to become even less invasive, leading to faster healing times, minimized discomfort, and improved patient satisfaction[15]

**Teledentistry:**

The combination of V-MIS with teledentistry could allow for remote diagnosis and minimally invasive procedures in underserved areas.

**Cost-effectiveness:**
For V-MIS technology to be widely adopted, it is imperative that it be available and reasonably priced for both patients and dentists.[14].

By addressing these challenges and continuing technological advancements, V-MIS has the potential to revolutionize dental surgery, offering a minimally invasive and patient-centered approach to a wide range of procedures.

**Clinical studies of videoscopetechnology :**

1)Harrel et al. in 2014,conducted a case series involving 110 sites across 30 patients with residual probing pocket depth (PPD) of at least 5 mm, 2 mm clinical attachment loss (CAL), and radiographic bone loss was investigated. These patients underwent Videoscope minimally invasive surgery. Six months post-surgery, re-evaluations showed that all PPDs had reduced to 3 mm or less. Additionally, there was an increase in soft tissue height and a decrease in recession. The study concluded that the improvement in PPD and CAL achieved with Videoscope minimally invasive surgery appears to be favorable compared to

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previously reported outcomes of periodontal regenerative surgery.

2)Dunegan KA et al conducteda study in 2023to evaluate the impact of videoscopewhen used as an adjunct to scaling and root planing on periodontally hopeless teeth scheduled for extraction. Surfaces were evaluated using surgical loupes in control group and videoscope in test group. Totally 25 extracted teeth were taken with 89 interproximal surfacesin evaluationand found out thatsurgical loupes were better than videoscopes.Althoughvideoscope provides excellent visual access it did not increase root planings effectiveness for smooth interproximal surfaces.Small amounts of calculus still remain after instrumentation albeit the appearance of visually clean and tactilely smooth surfaces.[16]

## CONCLUSION

One important development in dental practice is the use of videoscope technology in minimally invasive periodontal surgery. This novel method reduces tissue damage and speeds up patient recovery by improving visualization and enabling more accurate surgical operations. The advantages of less pain following surgery and better cosmetic results highlight how crucial it is to use videoscopes during periodontal operations. More research is required to analyse long-term results and establish standardized techniques as the field of study continues to grow. In the end, using videoscopic procedures can result in better patient outcomes and satisfaction, making this technology an essential part of contemporary periodontal therapy.

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