



Minimally Invasive Techniques-A Periodontist's Point Of View

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ABSTRACT

The concept of Minimally Invasive Dentistry has seamlessly blended into the various fields of dentistry including periodontics.

Periodontal diseases are heterogeneous in nature with a multi-factorial etiology. The ultimate goal of periodontal therapy is the restoration of the lost periodontal tissues and is usually a complex and daunting task. The past three decades have witnessed a gradual integration of various branches of dentistry, which promote the use of minimally invasive procedures ranging from magnification devices to advanced surgical techniques and armamentarium. This in turn translates into the resolution of the disease with minimal post-operative pain, morbidity and patient compliance. This essay attempts to highlight the use of minimally invasive procedures in periodontics and emphasizes the incorporation of magnification with microscopes in periodontal practice.

Key words: microsurgery, minimally invasive, nanotechnology, periodontal therapy, non-surgical

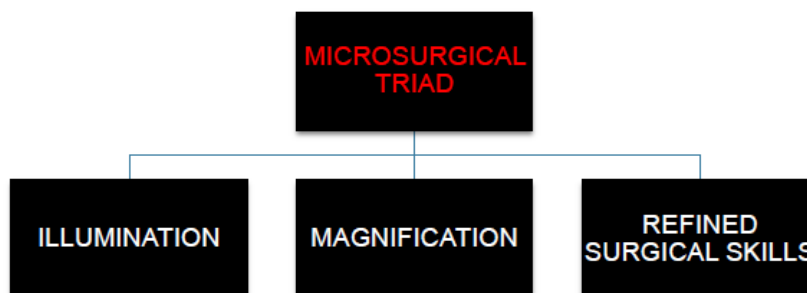
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I. INTRODUCTION

The art of dentistry is precision and precision defined dentistry! The past 3 decades have witnessed a gradual integration of various branches of dentistry, so as to optimize patient care with an inter-disciplinary approach. Minimally invasive dentistry (MID) is defined as those techniques, which respect the health, function and esthetics of oral tissue by preventing the disease from occurring or intercepting its progress with minimal tissue loss.^[1] There is a paradigm shift in the philosophy of G.V Black from "Extension for prevention" to "Minimally invasive Dentistry" and involves the early diagnosis, of oral diseases with optimal conservation of tooth structure.^[2,3]

Current Scenario of MID in periodontics

Figure 1. The Microsurgical Triad



Belcher et al had named the three elements, i.e., Magnification, Illumination, and Refined surgical skills by instruments as the *Microsurgical triad*.^[4][Figure 1]

MAGNIFICATION AND ILLUMINATION (Table 1)

Illumination and magnification are achieved with surgical operating microscopes and loupes using fiber optic technology. Optimal magnification and illumination will synergistically translate into improved dexterity and precision of the operator.^[5]

TABLE 1. Magnification systems and their structural components.

A. Loupes	B. Surgical Operating Microscope
Simple loupes: A pair of single meniscus lenses	Eyepieces with 12.5X reticule
Compound loupes: Multielement lenses	Objective lens 200-250mm
Prism loupes: Schmidt or rooftop prisms, eyeglass frames or headbands	Binocular incline at 180 degrees
Galilean loupes: Consists 2or 3 lenses	Magnification changer
	Fiberoptic illumination system
	Audiovisual accessories (e.g.: video camera)
	Documentation

REFINED SURGICAL SKILLS

TABLE 2. Periodontal microsurgical instruments

NAME	TYPE	SUBTYPES	ADVANTAGES
Knives	a. Blade breaker knife b. Crescent knife c. Minicrescent knife d. Spoon knife e. Lamellar knife		<ul style="list-style-type: none"> Extremely sharp Small size Produce more precise wound edge
Microsurgical periodontal knives	<ul style="list-style-type: none"> Orban's knife Kramer-Nevins' gingivectomy knife 		<ul style="list-style-type: none"> Very sharp
Microsurgical blades	<ul style="list-style-type: none"> Ophthalmic knife Blade no.15 Blade no.12 Blade no.390 Blade no.390C 	Blade no.15C Blade no.12D	<ul style="list-style-type: none"> Curved in a J shape Can be run under the papilla to separate it from the underlying bone support. Fine incision
Microsurgical periodontal retractors	KP retractors	<ul style="list-style-type: none"> KP 1 retractor KP2 retractor KP 3 retractor 	Wider and thinner serrated working ends provide better anchorage on bone and prevent accidental slipping
Microsurgical tissue forceps	Microsurgical anatomic tissue pliers TPASTMBH Microtissue forceps 180		Handle minute tissues without damaging them
Microsurgical periodontal chisels	<ul style="list-style-type: none"> Rhodes chisel Wedelstaedt chisel Fedi chisel 		Precise bone cutting
Microsurgical periodontal curettes	SL1/2RMBH SL3/4RMBH SL5/6RMBH		
Microsurgical periodontal needle holder	Microneedle holder Schlee (NHSLSCHLEE)		<ul style="list-style-type: none"> Lock to firmly secure the needle Can be guided through

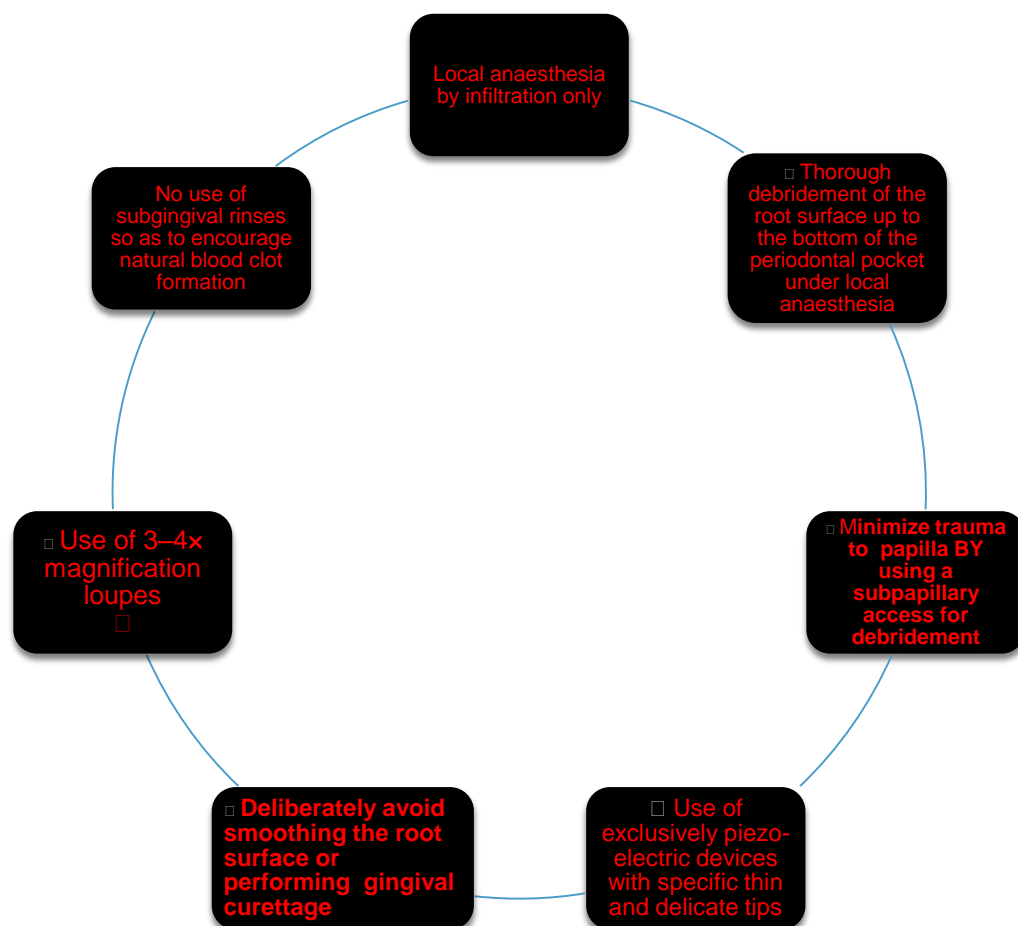
			coarse gingival tissue with controlled grip pressure <ul style="list-style-type: none"> • Slender shape allows them to reach far into interproximal areas
Microsurgical suturing forceps			Can easily grab micro sutures which can be torn with usual surgical suturing forceps
Micro scissors	a. Micro-vannas tissue scissors b. Goldman-Fox scissors c. Ligature scissors FD252R		Smooth cutting of fine and coarse tissues Reduced tissue trauma
Micro sutures	6-0 to 10-0	Vicryl polyglactin (7-0 to 10-0) Ethilon polyamide (7-0,9-0) Prolene polypropylene (8-0,10-0)	Better wound closure Minimizing gaps or voids at the wound, rapid healing with less post-operative inflammation, pain and risk of scar formation
Microsurgical needles	<ul style="list-style-type: none"> • Reverse cutting needles with precision tips • Spatula needles with microtips 		Shallow needle track and precise needle point allows extremely accurate needle apposition and closure of flap

There has been a paradigm shift in technologies from resective to regenerative procedures; these necessitate the use of microsurgical instruments in combination with different regenerative materials along with magnification so as to achieve optimal healing and wound closure. MIPT includes both non-surgical and surgical procedures; which primarily maintain the preoperative gingival architecture, minimize post-operative discomfort along with gentle handling of the tissues.^[6,7] (Table 2)

Minimally invasive nonsurgical therapy (MINST)

Management of periodontal vertical bony defects is always challenging since they are associated with a higher risk of disease progression and subsequent tooth loss.^[8] The concept of minimally invasive, non-surgical therapy (MINST) was first proposed by Ribeiro et al^[9]; they advocated root surface debridement with slim ultrasonic tips and minicurettes, so as to preserve the architecture of the soft tissue. Studies have shown that a protocol of MINST resulted in a reduction in the depth of bony defects by approximately 3mm; results of which are stable for at least 5 years after treatment.^[10,11] A modification of the same (Modified MINST) protocol was given by Nibali et al^[11] and illustrated in Figure 2.

Figure 2. Modified MINST protocol



THE CHANGED VECTOR OF THE CASE DEFINITION OF MINIMALLY INVASIVE SURGERY (MIS)

Harrell and Rees (1995) first introduced the term minimally invasive surgery (MIS) ^[12], which was later, re-defined as microsurgical procedures involving the use of microsurgical instruments and materials with the goal of obtaining regeneration of the bone and supporting tissues with better esthetic results as compared to conventional surgical procedures. ^[13]

MIS entailed visualization of the root surfaces of teeth and bony defects with surgical telescopes, by reflecting small buccal and lingual flaps. However, MIS resulted in gingival recession, which was only slightly lesser than those resulting from traditional periodontal procedures. Cortellini and Tonetti modified the original MIS procedure and renamed it the Minimally Invasive Surgery Technique (MIST). [Figure 3] It differed from the MIS procedure by incorporating the papilla preservation flaps and visualization of the bony defects through a microscope. ^[14]The original papilla preservation technique (Figure 4) proposed by Takei ^[15] was improved by Cortellini et al (Figure 5) to facilitate interproximal regenerative procedures. ^[16,17]In 2009, Bianchi and Bassetti ^[18] designed a new surgical technique – the “Whale's tail” technique, for the treatment of wide intrabony defects in the esthetic zone.(Figure 6) In order to treat multiple areas of recession on contiguous teeth, "tunnel" techniques were used^[19,20] which were later on refined with newer minimally invasive procedures like the Laterally closed tunnel technique ^[21]Figure 7, the Vestibular incision sub periosteal tunneling technique (VISTA) ^[22]Figure 8 , and the pinhole surgery. ^[23]Figure 9.

Figure 3: Salient Features Of MIST

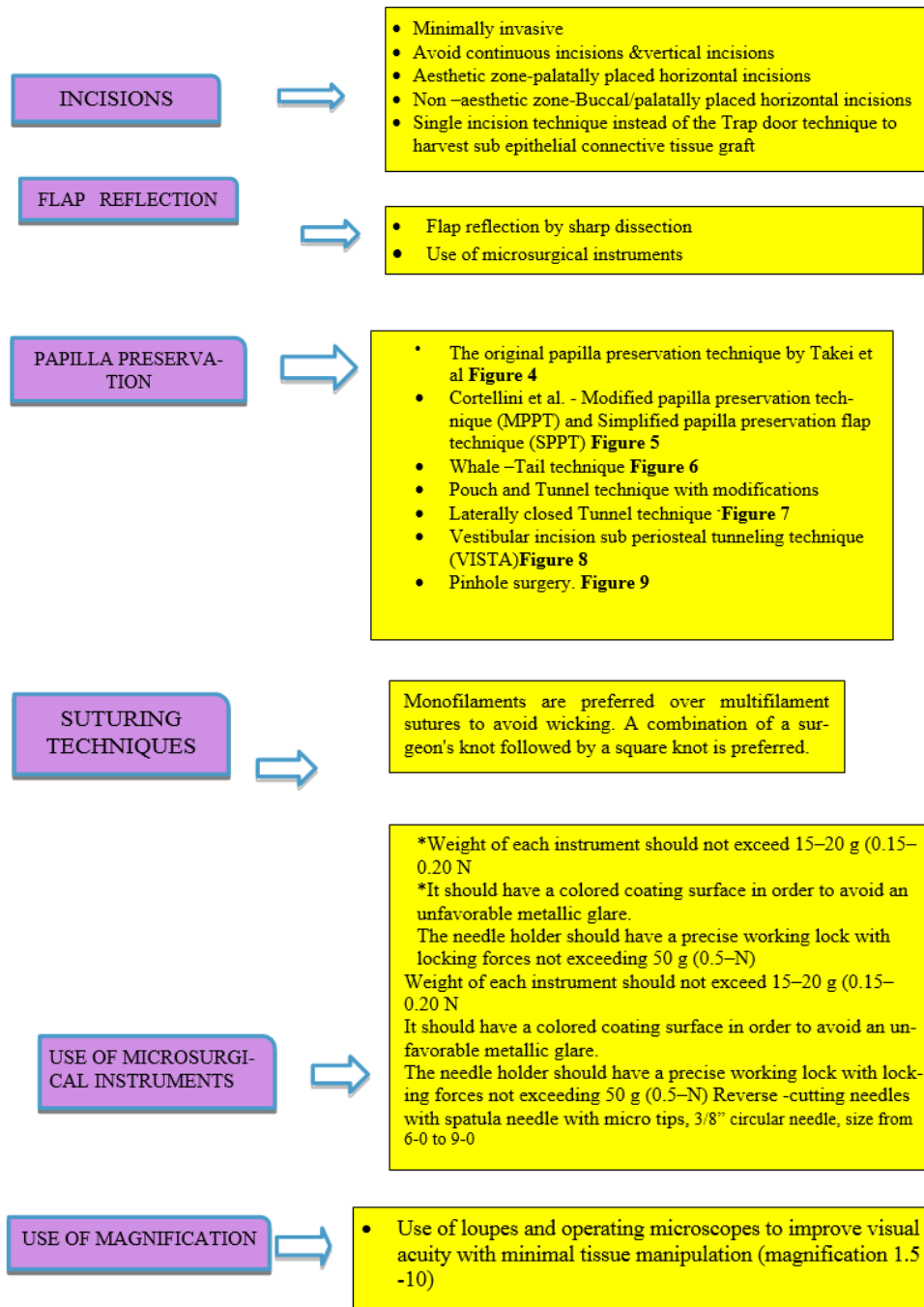


Figure 4: Papilla preservation flap



Figure 5: Modified and Simplified Papilla Preservation Flap

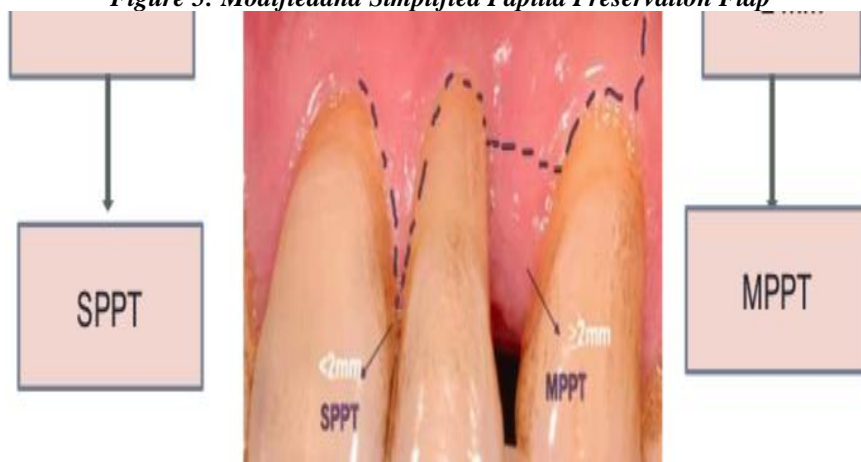


Figure 6: Whale Tail Technique

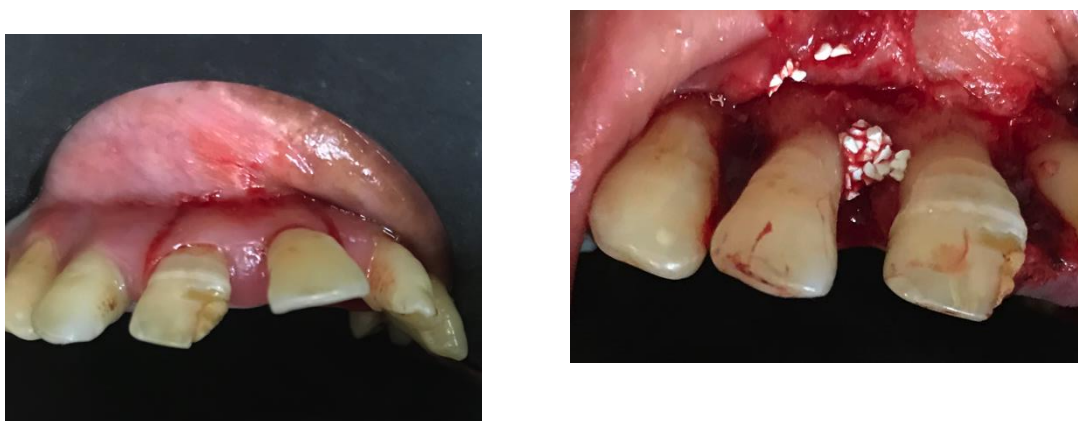


Figure 7. The Laterally Closed Tunnel.

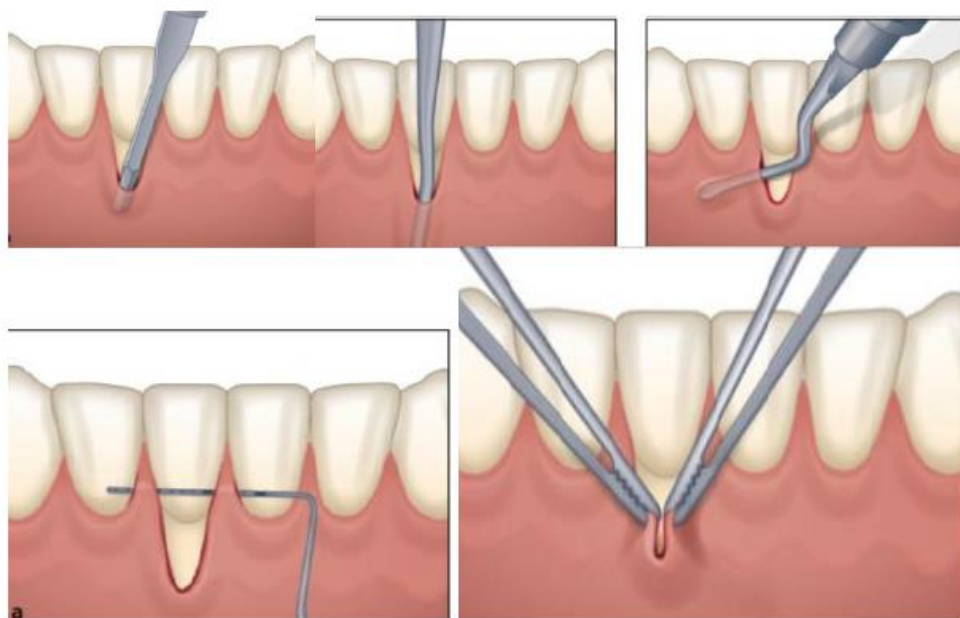


Figure 8:VISTA Technique

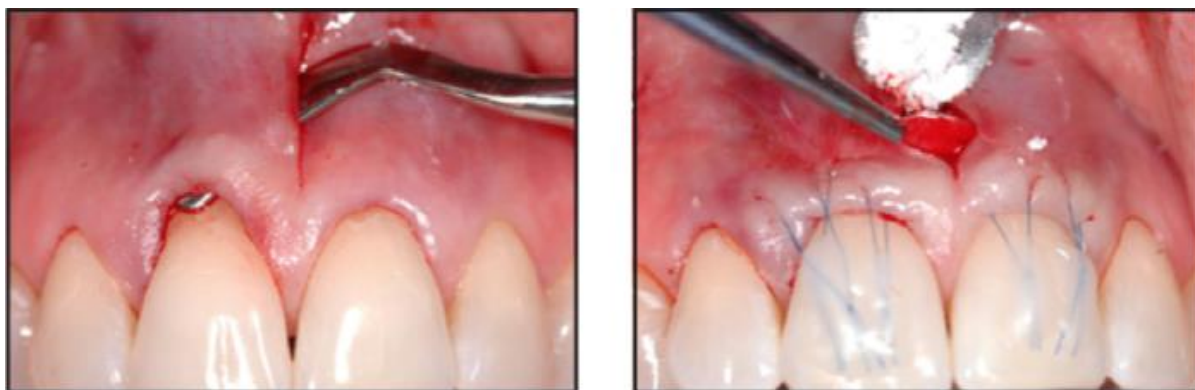


Figure 9: Pin –Hole surgery



Cortellini et al modified the MIST and named it **M-MIST**, which introduced only a buccal flap for better aesthetics.^[24]

APPLICATION OF MIPT

1.Laser- assisted periodontal therapy

Nd: Yag Lasers have been used successfully for Laser- assisted new attachment procedures (LANAP) and are minimally invasive periodontal pocket treatment modality. It is the only laser procedure to have human histologic evidence of cementum- mediated periodontal ligament attachment.^[25,26]

2.Root coverage procedures

A systematic review by Kang et al in 2015,^[27] included four randomized clinical trials (RCTs); they concluded that complete root coverage by Sub-epithelial connective tissue graft (SCTG) was obtained with microsurgical procedures (using an operational microscope and microsurgical instruments) and yielded better aesthetics and greater predictability than the conventional surgical procedures.

A systematic review by Moro et al (2020)^[28] gave a similar result; they had concluded that magnification improved the percentage of root coverage in surgical treatment of gingival recession.

3.Papilla reconstruction

Conventional surgical procedures generally involve vertical releasing incisions, which compromise the vascularity, jeopardize the aesthetics by scarring, and cause increased postoperative discomfort. Nordland et al had demonstrated predictable aesthetic outcomes in the reconstruction of the lost interdental papilla with the use of magnification, microsurgical instruments and surgical technique without vertical incisions.^[29] Burkhart and Lang have demonstrated superior aesthetics and vascularity with microsurgical techniques.^[30]

ADVANCES AND FUTURE PERSPECTIVES IN MINIMALLY INVASIVE PERIODONTAL SURGERY

1. *Videoscope -Assisted Minimally Invasive Surgery (VMIS)* –A study by Harrell et al in 2014^[31] concluded that there was a statistically significant reduction in post -surgical probing pocket depth and clinical attachment loss in 1-3 walled defects done using the VMIS technique.
2. *Periodontal Endoscope with Micro Ultrasonic Instruments*-A non-invasive method for the visualization of the sub gingival sulcus is made possible with a **Perioscope**, which is superior to the loupes and microscope as it has comparatively lesser distortion of images and is relatively impervious to movement.^[32,33][Figure 10,11]

Figure 10. *Perioscope*

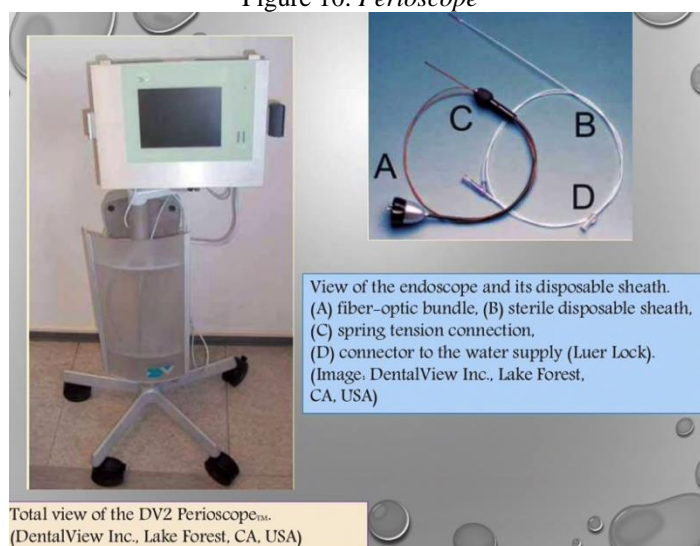


Figure 11. *Fiber optic endoscope*

- The fiberoptic endoscope fits onto periodontal probes and ultrasonic instruments that have been designed to accept it



Viewing periodontal explorers (left/right/full viewing) for the Perios
(Courtesy Perioscopy Incorporated, Oakland, CA.)

3. *Periodontal ultrasonography(USG)*–Since they are non-ionizing and non- invasive, USG plays an important role in periodontal diagnostics to assess periodontal health, in surgical procedures like sinus lift and osteotomies by piezoelectric ultrasonic vibrations. They also play a vital role in periodontal regeneration.^[34]
4. *Robot-assisted minimally invasive surgery*–This technique improves the dexterity of the dentist with atraumatic procedures using a telerobot or tele manipulator and watching the operation through a 3-D video.^[35]

II. Conclusion

Change is the only constant!!!

Minimally invasive procedures offer the advantages of being aesthetically –driven, less invasive with greater patient compliance and clinician acceptance. However, we must exercise caution before espousing the concept of MIPT; an evidence-based approach is required for its incorporation into the optimal management and treatment of patients at a global level.

Total Word Count-1100 (Excluding Abstract, Legend, References, Diagrams)

References- 35

LEGENDS

Figure 1: The Microsurgical Triad

Figure 2: Modified MINST protocol

Figure 3: Salient Features Of MIST

Figure 4 : Papilla preservation flap

Figure-5-Modified and Simplified Papilla Preservation Flap

Figure 6: Whale Tail Technique

Figure 7: Laterally closed Tunnel technique

Figure 8: VISTA Technique

Figure 9: Pin –Holesurgery

Figure 10. Perioscope

Figure 11. Fibre optic endoscope

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