Minimally Invasive Methods for Treatment of Periodontal Defects: A Case Report

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Abstract: Treatment of periodontal diseases is a complex issue because of the difficult access to the root surface. Both the surgical and the nonsurgical method have their importance and place in the treatment of periodontal diseases. Nonsurgical treatment can be used independently, as a definitive or as a preparation for the surgical treatment. Access-Open flap surgery is the gold standard for treating periodontal diseases.

Objectives: To demonstrate the possibilities of two minimally invasive methods-Minimally Invasive Surgery Technique performed with Er:YAG lazer and Regenerative Ultrasonic Periodontal Endoscopy for treating chronic periodontitis.

Methods: Female patient age 45 was diagnosed with chronic periodontitis after X-ray examination. On her second lower molars the following pathology was found Probing Pocket Depth=6mm and infraossal defects with INFRA=3mm. Tooth 47 was treated with open flap curettage with an Er:YAG laser by the Minimally Invasive Surgery Technique. Regenerative Ultrasonic Periodontal Endoscopy was performed on tooth 37. The root surfaces of 36 and 37 were manipulated under indirect visual control and continuous irrigation with the help of periodontal endoscope DV2 Perioscopy System™ and ultrasonic tips EMS®, scaler Piezon Master 400®

Results: After a period of one year the following results were achieved: 1) No bleeding on probing. 2) Probing Pocket Depth 3mm 3) Complete bone regeneration-fill 4) Less gingival recession with RUPE

Conclusions: Based on the outcome of the minimally invasive procedures, they can be recommended as suitable and alternatives to the standard nonsurgical and surgical techniques.

Keywords: Er:YAG, RUPE, Infrabony defects.

INTRODUCTION

Treatment of periodontal diseases is a complex problem due to the difficult access to the root surface and the presence of multiple soft and hard deposits in the periodontal pocket. Furthermore, metabolism of microorganism results in variety of toxic products which is a major difficulty for neutralization. Additional complication is the fact that periodontitis has a unique nature of infectious destruction that is self-stimulated in the presence of irritants. Both surgical and non-surgical methods like Scaling and Root Planning-SRP and access flap surgery have their place and importance in the treatment of periodontal diseases. Non-surgical treatment may be used either alone as a curative treatment, or to prepare for surgical method. Surgical treatment of the access flap is the gold standard in treatment of periodontitis, especially for infraossal defects. Until now, only surgical therapy enables direct visual access to the root surface, but with the development of endoscopy, techniques are perfected and apparatuses give periodontologists indirect, visual, illuminated, increased image of the root and access to its surfaces. The combination of ultrasound and endoscope gives us a method which can be called Regenerative Ultrasound Periodontal Endoscopy-RUPE, which combines the advantages and properties of the two modalities.

On the other hand lasers as transmitters of energy distantly from the original source have multiple properties on biological objects, such as ablation, necrosis, coagulation and regeneration. Based on the properties of their wavelength of 2094nm / Er:YAG lasers can affect both hard and soft tissues. Moreover, one of the most useful properties of lasers is their ability to disinfect and biomodify root surfaces, thereby ensuring consistent and detoxified plane and medium for new connective tissue attachment and periodontal ligament regeneration. Lasers can be used in non-surgical or surgical fashion. When used for surgery they ease treatment protocol because a single unit with multiple tips different in shape and function can replace the standard surgical set of instruments for periodontology.

OBJECTIVE

The purpose of this article is to acquaint the reader with the capabilities of Er:YAG (Light Touch™, Sineron®, Israel) laser and RUPE for the treatment of soft and hard tissues. Specifically, their application in periodontology for the treatment of infraossal defects

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by minimally invasive surgical and nonsurgical methods and comparison of the two techniques.

METHODS

A 50 years old female patient came to the clinic complaining of bleeding when brushing and progressive elongation of teeth and recession of gums. X-rays revealed moderate to severe chronic periodontitis with the presence of infraossal defects on the lower second molars (Figure **1**). Initial periodontal treatment was conducted including supra and subgingival removal of hard and soft deposits with ultrasound apparatus-Piezon Master 400 ® (EMS®, Switzerland) and hand tools- Gracey Curettes (Hu-Friedy®, USA). Review one month later revealed bleeding pockets with probing pocket depth of 5 mm at both molars and presence of infraossal bone defects INFRA ≥ 3 mm [5, 6, 12, 27]. Laser surgical treatment with access flaps utilising the Minimally Invasive Surgical Technique was done on tooth 47 [10, 14]. After that we adopted Regenerative Periodontal Endoscopy for tooth 37 two weeks later [1, 3, 28-31, 37-39]. MIHT is performed entirely using the Er: YAG laser (Light Touch^{TM}, Sineron ®, Israel) [35, 40], a methodology introduced by Cortellini and Tonetti. The technique involves use of minimally invasive access flaps for treatment of infraossal defects. It utilizes simplified papilla preservation technique-SPPT to keep the papilla when width of the interdental space is under 2 mm and the modified papilla preservation technique-MPPT when it is wider than 2 mm. Flaps are reflected minimally and atraumatically. Intrasulcular incisions reach the mid of the facial and lingual surfaces of adjacent teeth next to the defect. No vertical incisions are performed, and when the flaps need to be mobilised extra, additional interdental spaces are included. Their reflection never passes the mucogingival junction. Vertical mattress sutures are used to close defects with or without a simple interrupted suture above them [10, 14, 15, 16].

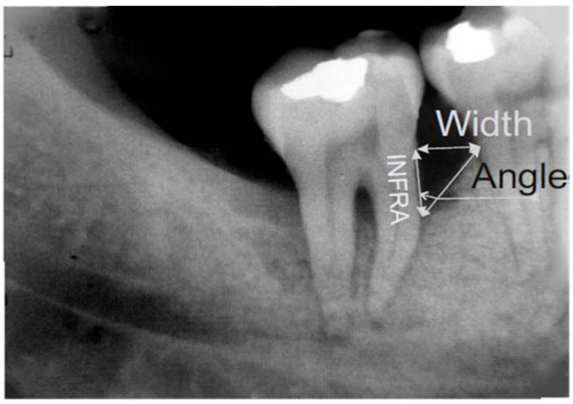


Figure 1: Parameters of infraossal defects.

After inferior alveolar nerve block with tip for incision an intrasulcular incision cut(contact mode; 200mJ/ 35Hz; 0,4x17mm tip, water level 5-6) is done to the mid-facial and lingual surfaces of teeth 46 and 47 with SPPT [2] as the interdental space was less than 2 mm. (Figures **2, 3**). Then using a tip with the shape of a cylinder ablation of the granulation tissue (non-contact mode; 400mJ/17Hz; 1,3x14mm tip; water level 6) in the bone defect and on the soft wall of the pocket is done (Figure **4**).

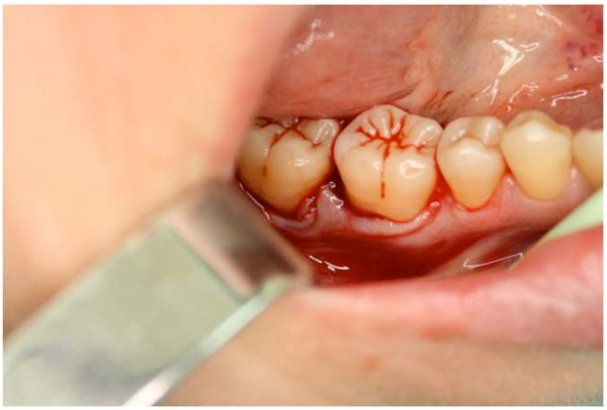


Figure 2: Simplified Papilla Preservation Technique.

Figure 3: Tip for incisions.

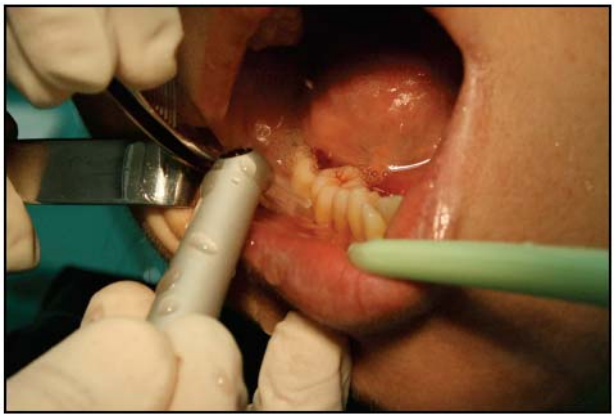


Figure 4: Tip for ablation of granulomatous and recontouring of bone tissue.

Then chisel type tip (non-contact mode; 100mJ/ 35Hz; 1,3x19mm tip water level 8) and with Gracey curettes (Hu Friedy®, USA) we verify that the root surfaces of teeth 46 and 47 are free of soft and hard deposits. The edges of the flap are approximated with 5.0 Safill thread using the plain interrupted single interdental suture (Figures **5, 6**), which is not a standard for MIHT which uses vertical mattress sutures. Then the defect is compressed for 5 minutes with gauze soaked in saline. After which the patient is instructed to maintain oral hygiene with Modified Stillman Brushing Technique and rinses with chlorhexidine solution 0.2% for a period of three weeks. The patient is included on supportive periodontal regimen and check-ups on the first day, after a week, first month, and then on third, sixth, ninth and twelfth month [7].

Figure 5: Debrided infraossal defect on tooth 47.

Figure 6: Single interrupted suture on tooth 47.

Two weeks later after MIHT we carried Regenerative Ultrasound Periodontal Endoscopy-RUPE on tooth 37 [1,3]. After alveolar nerve block anaesthesia RUPE is conducted as follows. Using an endoscope DV2 Perioscopy System ™ (Figure **7**) and ultrasonic tip for subgingival removal of hard deposits with Piezon Master ® 400(EMS®, Switzerland) we debride under indirect visualisation and with continuous irrigation the root surfaces of the teeth 37 and 36 (Figures **8, 9**). Then we proceed to the soft tissues above the bone defect using the same tip. The procedure ends with modifying the bottom of the defect making small puncture perforations in the bone in order to stimulate blood flow rich in regenerative factors. Then the defect is compressed again for 5 min with gauze soaked in saline. Instructions to the patient for maintenance are the same as in the surgical procedure.

Figure 7: DV2 Periosocpy System™.

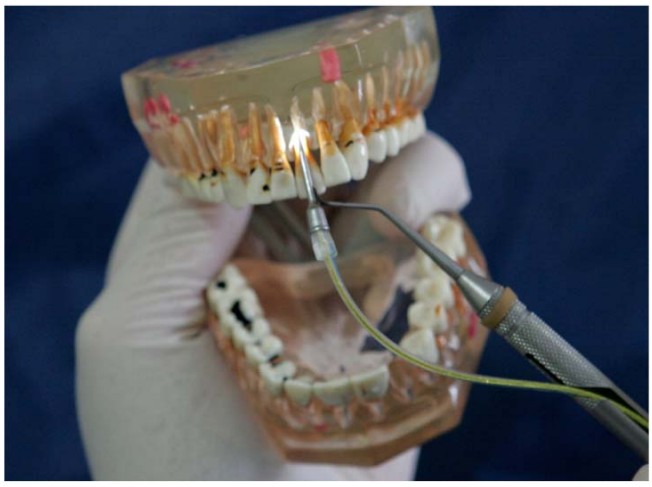


Figure 8: Illumination and position of explorer inside periodontal pocket with DV2 Perioscopy System™.

Figure 9: DV2 Perioscopy System® explorers in use on tooth 37.

After one year in both treatment methods MIHT with Er:YAG and RUPE we have the following results: no bleeding on probing is observed, reduction of probing pocket depth-PPD and complete fill of the infraossal bone defects (Figure **10**). In both cases we establish that there is: (Table **1**).

Re-growth of bone and reduction of PPD. RUPE has better Clinical Attachment Level-CAL gain and less recession compared to MIHT.

DISCUSSION

After both techniques MIHT with Er:YAG and RUPE we found satisfactory clinical results, Both methods led to resolution of the infraossal defects and reduction of PPD. RUPE as a term is introduced in 2012 by Thomas Brucatto and Judy Carol which use Emdogain® as grafting material [1,3]. RUPE lead to less recession, (Table **1**) which is comparable with results of other authors, which follow clinical parameters and recession from one up to 3 years [28-31, 37-39]. Kwan's [28-31] methodology called Micro Ultrasonic Periodontal Endoscopy does not use grafts, but we think that periodontal regeneration is possible even without them [17]. Our findings with respect to recession after MIHT differ from those of Cortellini and Tonetti, which achieve significantly lower recession compared to other standard surgical techniques for periodontal surgery or guided tissue regeneration [10, 11, 14-16]. MIHT is based on research done by Harrel, who uses minimally invasive surgery-MIS with [21,22] and without [20,23,24] regenerative grafting materials and manages to keep clinical outcomes positive and unchanged over a period of 6 years using that technique [21].

Cortellini and Tonetti, develop and use the simplified and modified papilla preservation technique [8,13], and then introduce MIHT [10, 14-16] which is subsequently modified in the modified MIHT (M-MIHT) which uses single buccal flap access for treatment of infraossal bone defects and yields even more and statistically significant results compared to ours [9, 11].

A drawback of the study is the minimum number of defects studied and undergoing therapy. More clinical research with bigger study group would allow us to capture a statistical difference between the two methods. We think that RUPE is perceived better by patients because it is less-traumatic and does not include surgical access, reflection of flaps and incisions. We think that there is a possibility of bone regeneration and fill of the infraossal defect (Figure **10**), not just increase in mineralisation, as observed and discussed with other nonsurgical techniques using hand or ultrasonic powered tools [33]. Of course bone fill can be due to the improved oral hygiene and the long support period. Because the endoscope gives 48x magnification of the root surface we think that in combination with ultrasound it provides a very accurate method to remove all soft and hard deposits on the root surface, which leads to a significant improvement in clinical indicators, which is establish also by Chechi [2] and it is better in detection and removal of subgingival deposits in comparison with conventional scaling and root planning –SRP [18]. Combined MIS technique with the help of an endoscope achieves a significant advantage over, the standard surgical techniques for flap access in relation to all clinical parameters of periodontal health-PPD, CAL, recession [26]. The use of lasers in periodontal therapy is still controversial and, according to some authors does not give better results than a standard SRP, but results in significant defects, fractures, thermal incineration and even damage which

Table 1: Results of MIHT with Er:YAG and RUPE One Year after Treatment

Group	PPD-start/mm	PPD-1year/mm	REC-start/mm	REC-1 year/mm	Bone depth start/mm	Bone depth 1-year/mm
1-RUPE	5	3	0	1	3	0
2-MIHT with ER:YAG	5	3	0	3	3	0

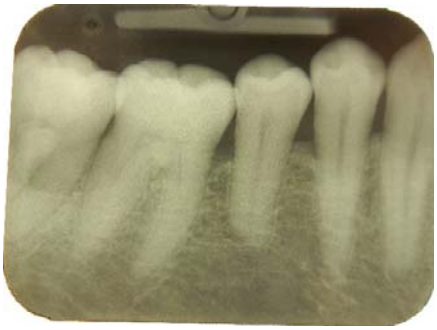
Period	MIHT with ER:YAG	RUPE
Before		
After 1 year		

Figure 10: Infraossal defects before and after treatment.

reaches up to the dentin [32, 35, 40]. In the future research can be done on how patients perceive non-surgical methods and how they evaluate it as Cortellini and Tonetti did [15]. Although both techniques use minimally invasive access RUPE has shown better results with regard to CAL and gingival recession. This may be due to the change in the suturing technique with MIHT, the technique of performance, manuality and experience of the clinician.

In our opinion and according to others [34, 36] the future of periodontal therapy belongs to minimally invasive techniques and tools.

CONCLUSION

Both treatment methods MIHT with Er:YAG and RUPE can be used in treatment of infraossal periodontal defects.

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