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Review Article

The LANAP Protocol (laser-assisted new attachment procedure) - A Minimally Invasive Bladeless Procedure.

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ABSTRACT:

This article presents a general description of the LANAP® Protocol (laser-assisted new attachment procedure) and the benefits of its use to patients. The LANAP procedure is a protocol that deals with inflammation, the infectious process, occlusion, tooth mobility, and an osseous component. The LANAP protocol is rather simplistic. Used by a trained and certified dentist or periodontist, it is a surgical laser procedure designed for the treatment of periodontitis through regeneration rather than resection. The ultimate goal is to set up the periodontal environment to promote self-regeneration of the lost attachment and osseous structure that result from periodontal disease. Regeneration is a rather complex event and, as seen with guided tissue regeneration or scaling and root planning alone, can be very unpredictable. LANAP is predictable.

Keywords: Nd-YAG lasers; LANAP; periodontal attachment loss; periodontal pocket; periodontal regeneration

KEY MESSAGE: Laser-assisted new attachment procedure (the LANAP protocol) is a surgical therapy designed for the treatment of periodontitis through regeneration rather than resection.

INTRODUCTION

The focus of periodontal surgical procedures has shifted over the past three decades from a philosophy based on resection (subtractive) to one of regeneration of lost tissues (additive). This shift has had particular significance in cases of advanced periodontitis. When a patient presents with severe attachment loss, regeneration cannot take place until the etiologic factors have been effectively managed or reversed and the disease progression arrested. Traditional surgical techniques have been successful in facilitating access and addressing the goal of "pocket elimination." However, such surgical methods often result in unpleasant side effects, which can be painful and disfiguring. Clinicians have come to accept previous tissue breakdown as often irreversible. Additionally, the theory behind conventional pocket elimination was to produce an environment that promoted ongoing disease control by facilitating personal oral hygiene. At its best, traditional pocket surgery often falls short of achieving these goals and objectives. Additionally, conventional resective surgical techniques do not adequately address esthetic concerns, whereas surgical techniques, which are directed toward regeneration, have as their ideal outcome the preservation and/or restoration of lost periodontal tissues.`

Laser therapy remains controversial in the field of periodontics.[1-3] Lasers of varying wavelengths (635 to 10,600nm) used for nonsurgical and surgical periodontal and peri-implant therapy include: diode, neodymium: yttrium- aluminium –garnet (Nd:YAG), Carbon dioxide, Erbium: yttrium- aluminium–garnet (Er:YAG).[4-7] It is important to note that lasers of varying wavelengths have different levels of tissue penetration depending on reflection, scatter and absorption.[8] Therefore, each therapy must be individually investigated with a specific laser. Each laser cannot be expected to replicate results of a laser of a different wavelength even when used to perform a similar therapy. Periodontal therapy utilizing a laser has been reported as a monotherapy, as an adjunct to scaling and root planning, for root debridement combined with surgical or non-surgical therapy,[9,10] and to perform surgical laser – assisted new attachment procedure (LANAP). [11,12]

The primary goal of periodontal therapy is to establish periodontal health with pocket reduction and attachment gain, preferably through periodontal regeneration.[13] Periodontal regeneration defined as establishing a new attachment apparatus on a previously diseased root surface via new cementum, new periodontal ligament(PDL), and new bone.[14] Multiple regenerative therapies have demonstrated adequate documentation of new periodontal structures regenerated adjacent to a calculus notch to meet these criteria.[15-19] These therapies all utilize surgical placement of a bone replacement graft material (autogenous , allogenic or xenogenic) or a biologic agent (growth factor or amelogenins) with or without the combination of barrier membrane . Most of these reports include the use of periodontal surgical flap procedures. Mellonig et al [20] reported the ability to stimulate periodontal regeneration when combining scaling and root planning with enamel matrix derivative application as a nonsurgical/flapless therapy.

There is desire among clinician's and patients to identify less invasive therapeutic options that can provide periodontal regeneration. Given the variation in clinical predictability of current therapies, it is unusual to provide full mouth therapy via regenerative techniques even though patients may present with periodontal disease throughout their dentition. There is an under treatment of periodontal disease based on patient and clinician perceptions regarding negative side effect of periodontal flap surgery such as pain, recession, dentinal sensitivity, and post operative discomfort.[12] Minimally invasive laser periodontal therapy utilizing the patented LANAP protocol has been advocated for periodontal treatment has limited clinical research demonstrating its efficacy and predictability. There is little known about the biology of wound healing process for these procedures.

The search for the "holy grail" of periodontal regeneration continues. Notwithstanding all of advances referenced above, predictable regeneration of periodontal tissues continues to be an enigma within a conundrum. Puzzling, contradictory, and controversial because of an incomplete understanding of its mechanism, it remains a lightening rod of ongoing controversy. For more than a generation, dentists have used lasers for a variety of applications in clinical dental practice. More than 10 years ago, Gregg and McCarthy published research on the use of a specific free-running pulsed neodymium:yttrium–aluminum–garnet (Nd:YAG) laser for the treatment of periodontal disease. First conceived and developed in the 1990s, they later proposed its use for achieving bone regeneration. [21,22] They developed a specific protocol, laser-assisted new attachment procedure (LANAP), with research-proven operating parameters. LANAP received Food and Drug Administration clearance in 2004. [23] An Nd:YAG laser was developed that operates at a wavelength of 1,064 nm to deliver the therapeutic LANAP.

The formal definition developed for LANAP is "cementum-mediated new attachment to the root surface in the absence of a long junctional epithelium." Patterned after the Excisional New Attachment Procedure (ENAP), LANAP is designed to remove diseased and necrotic tissue selectively from within the periodontal sulcus. However, the LANAP utilizes a free-running (10-6 seconds) pulsed Nd:YAG laser in place of a scalpel. Originally referred to as Laser-ENAP, LANAP has evolved to provide a minimally invasive alternative to flap surgeries.

The potential for regeneration is facilitated by: 1) delivering intense, precise, and selective energy to the affected area (periodontal pocket), without damage to adjacent tissues; 2) being bactericidal to pigmented periodontal pathogens; 3) sealing the pocket orifice with a "thermal fibrin clot "; 4) creating a physical barrier (such as a barrier membrane), preventing down growth of epithelium; and 5) promoting healing from the bottom up rather than the top down by stimulating the release of pluripotential cells from the PDL and alveolar bone. Despite the initial controversy surrounding aspects of LANAP, the procedure represents a precise treatment protocol, combining the best aspects of laser-mediated surgery with the well-established principles of traditional periodontal therapy. The goals are the same, but the application of methods for achieving these objectives is markedly different. In all cases, consistent with LANAP, aggressive debridement of all pockets/defects is accomplished with high-power piezo scalers. Conversely, notwithstanding that the goals parallel each other, there are many substantial benefits attributed to LANAP therapy when compared to conventional periodontal surgery. The benefits have been described as less invasive and less traumatic, minimal postoperative discomfort, minimal recession and thermal sensitivity, quicker healing, and equally successful results treating dental implants and natural teeth. The concept of LANAP was born back in 1989 with Drs. Robert Gregg and Del McCarthy. They were involved in the early use of Nd:YAG lasers in dentistry. Confronted with patients not wishing to lose teeth and declining traditional surgery or extraction, they developed the LANAP protocol. In one of the largest human histology studies, Yukna et al[24,25] were the first to publish and prove incontrovertibly the positive results of LANAP therapy when compared to conventional periodontal treatment. The study was university based, longitudinal, controlled, prospective, and masked. The results showed unequivocally that 100% of the teeth treated with LANAP formed new attachment as opposed to 0% of the control teeth. More recently, in 2012, Nevins et al reported another landmark human block study demonstrating highly successful outcomes of patients treated with LANAP in cases of extreme periodontitis. What follows are examples of various clinical cases illustrating favorable results using LANAP. In all cases, in accordance with LANAP, mobility and other manifestations of occlusal pathology were assessed. The occlusion was carefully addressed and managed using a combination of procedures.

The LANAP protocol

Step A

Patients undergo a full dental examination and treatment plan—as with all dentistry. If they have an appropriate diagnosis of Type III or greater periodontal disease, all treatment options are presented to the patient. The initial step of the LANAP protocol, after anesthesia has been administered, is bone sounding around each tooth. The objective is to determine areas of osseous defects that cannot be seen radiographically.

Step B

This is the first time the laser is used. The objective of this step is to remove only diseased epithelium, to affect selectively bacteria associated with periodontal disease, to affect the calculus present, and to affect thermo labile toxins. The bacteria that are associated with periodontal diseases are pigmented and are found in the sulcus, within the root surface and within the epithelial cells. One of the reasons for the predictability of this step is in the selection of a free-running pulsed Nd:YAG laser with a wavelength of 1,064 nm and pulsed in a range of seven different microseconds. The shorter 1,064 nm wavelength was selected for its affinity for melanin or dark pigmentation, unlike the longer wavelengths that are highly absorbed in water and would have a shallow depth of penetration. This ability to increase the depth of penetration of the laser energy with minimal collateral damage is the reason that the diseased epithelium can be selectively removed without damage to the underlying tissue, leaving intact rete pegs. The diode lasers are also known for this selective absorption in pigmented tissues, but the free running, pulsed Nd:YAG lasers differ in their ability to operate at very high peak powers in very short time-frames, which allows the Nd:YAG to have the greater depth of penetration and the lack of collateral damage (Fig.1).

Step C

This step in the LANAP protocol is straightforward; it is just a matter of using the piezo-scalers to remove the calculus present on the root surfaces. The removal of calculus is believed to be easier after the interaction of the laser energy with the calculus. The first interaction of the laser results in the initial formation of a mini-flap, thereby further assisting in the removal of calculus because of increased visibility and access to the calculus.

Step D

The next step again utilizes the laser. This time the parameters are varied to enhance the ability to form a fibrin clot to close the mini-flap and to disinfect the site again. The formation of the stable fibrin clot is significant, as it is stable for approximately 14 days. The role of the fibrin clot is to keep the sulcus sealed against bacterial infiltration and to prevent the growth of epithelium down into the sulcus. Other laser wavelengths not only lack the ability to form this stable fibrin clot, but also require repeated treatments to prevent epithelium growth down into the sulcus. The ability to select the laser–tissue interaction specifically is unique to the PerioLase MVP-7(Millennium Dental Technologies). Through the use of specific fiber sizes, energy, repetition rates, pulse durations and standardization of the energy at the fiber tip, this protocol can be followed in a predictable and reproducible manner. The high standard of training that each LANAP doctor receives also contributes to the predictability of this protocol and to its safety. Patients often present with different tissue types along with different degrees of disease. One of the purposes of the hands-on training is learning to recognize these differences and how to change the laser parameters accordingly so that the desired laser–tissue interactions are achieved (Fig.1).

Step E

The fifth step in LANAP is the compression of the fibrin clot to enhance the healing process. Because laser wounds heal by secondary intention, closer approximation enhances the healing time.

Step F

Following the compression and stabilization of the clot, the last step of LANAP is refining the occlusion. Occlusion has been considered a greater cofactor in the progression of periodontal disease than smoking. In order to minimize this role, extensive adjustments are made to the dentition. The patients are then followed for nine to 12 months with routine supra-gingival cleanings and occlusal refinements. No sub-gingival restorative or periodontal probing is done during this time. Only during the final post-operative visit is a periodontal probing done. The hallmark of LANAP is pocket reduction, new tissue attachment and a lack of tissue recession (Fig.1).

Laser surgery versus scalpel surgery

Thorough root surface debridement is critical to successful treatment of periodontal disease. It is difficult to remove sub gingival plaque and calculus in pockets that are 5.0 mm or deeper. A primary objective for surgical intervention is to provide access and visualization for scaling and root planing of these deep pockets. Traditional incisional surgery (such as a flap with osseous resection) results in reduced pocket depth due to apical repositioning of the gingival margin exposing the root surface to the oral cavity. Scalpel surgery could result in possible attachment loss, gingival cratering and gingival recession. The pain and discomfort associated with periodontal surgery is well known. By comparison, laser periodontal surgery eliminates pockets with minimal recession or repositioning of the gingival margin. Laser troughing makes it possible to visualize and access the root surface by removing necrotic debris, releasing tissue tension, and controlling bleeding. It also defines tissue margins prior to ultrasonic and mechanical instrumentation, preserves the integrity of the mucosa, and aids in maintaining the free gingival crest. This technique allows for selective removal of sulcular or pocket epithelium while preserving connective fibrous tissues. The hemostatic capability of intraoral laser surgery has been known and utilized for decades; to this end, the 1,064 nm wavelengths and 635 μ/sec "long pulse" used in LANAP are designed specifically to maximize intraoperative hemostasis and aid in therapeutic fibrin clot formation as the last step of the procedure. Dentists who practice laser sulcular debridement have reported high patient comfort and acceptance. Neill presented the results of patient surveys and clinician- administered surveys in his 1997 thesis: "All ten subjects were surveyed by the clinician immediately upon completion of the treatment appointment and then given a take-home questionnaire in order to assess the comfort levels over time. Results of the patient survey indicate that at three hours post-treatment, patients were comfortable, with half of the subjects reporting that they were extremely comfortable. The overall pain rating was 1.9 [on a scale of 0.0–10.0], indicating little to no pain was experienced.

CONCLUSION

LANAP is a well-defined treatment protocol, with human histologic validation and evidence of initial and long-term success. As the LANAP multicentre clinical studies move to completion, it would be reasonable to expect to see LANAP become the conventional manner or the standard for the treatment of periodontal disease. It is a very simple but eloquent protocol, one in which the patient has no to minimal discomfort and treatment acceptance is high. Continued research and careful observation will be necessary to sustain the clinical findings.

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