

# Using the AdvErL Evo laser for endodontic treatments

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**Fig. 1:** The Morita AdvErL Evo unit from the product group of Er:YAG lasers with an effective wavelength of 2,940 nm.



**Fig. 1**

## Introduction

I used a laser in a dental treatment for the first time in 1991. I was completing my residency and my superior had ordered a Nd:YAG laser to conduct PAR therapies in his practice. But, truth be told, my very first contact with a laser had actually taken place a couple of years previously. In 1988, when I was still a student at the University of Mainz, we were shown a laser made by ADL and told that it was considered to be the future of dental medicine. I was ambivalent about that as I could not see the much praised advantages of using lasers because, contrary to the promises made about the equipment, treatments were neither completely painless nor was the long-term quality of the treatments better.

As a matter of fact, it was evident that treatments using lasers in periodontology and dental surgery took significantly longer than conventional treat-

ment methods. The only positive aspect I was able to discern was faster wound healing.

In my opinion, this justified neither the high purchase price nor operating costs; and, so, I put the question of using a laser in dental medicine to rest as far as my own practice was concerned. And nothing caused me to change my opinion for the next 20 years. The much promoted revolution did not come about, the ever so innovative laser quickly descended to esoteric marketing for dental practices, whose only argument for a laser's *raison d'être* was that it conveyed the image of being a modern dentist.

My only points of contact with the medium were limited to reading endodontic studies within the scope of my own specialised endodontic practice. For the most part, the abstracts confirmed a reduction in bacteria; however, this reduction was not better in practical terms, perhaps even worse, than that achieved with such fundamental measures as irrigating with NaOCl.<sup>1,2</sup>

Moreover, the side effects of using a laser were mentioned as well, e.g. those caused by an excessive application of heat.<sup>3</sup> All in all, I had no reason to concern myself with the use of lasers in endodontics for more than two decades, not to mention investing a considerable amount of money in this type of equipment.

Endodontics, by comparison, experienced enormous progress during this period of time.

The use of nickel-titanium (NiTi) as a material for mechanical root canal instruments revolutionised the preparation procedure and smoothed the path for warm filling techniques. Electrical length measurements, dental microscopes and cone beam computed tomography (CBCT) became established, as did the use of ultrasound for irrigation, preparation of the primary and secondary access cavities, as well as pin/fragment removal. Nonetheless, a critical point throughout this time was the cleaning quality of our preparation methods<sup>4</sup>, which remained an unsolved problem in root canal treatments.

## The Morita laser AdvErL Evo

At the annual conference of the German Society for Endodontology and Traumatology (DGET) in Hamburg in 2014, David Jaramillo spoke about the so-called PIPS method using an Er:YAG laser.<sup>5</sup> It displayed outstanding results regarding the cleaning of root canals and dentinal tubules. This type of laser application, which uses an Erbium:YAG laser with an effective wavelength of 2,940nm, is no longer based on a direct thermal effect. Instead, endodontic irrigants are activated by small gas bubbles that form at the tip of the laser due to heat. As they move away from the tip, they cool down and collapse quickly. In this way, up to 50 bubbles per second are formed in quick sequence, forming a chain of bubbles that streams through the irrigant, pressing it into the branches of the root canal system and the dentinal tubules. Up until now, this had not been possible in an adequate manner, irrespective of whether activation was initiated with the help of sound, ultrasound or the SAF system.

The micro-explosions are the key element of this new treatment method. Micro-explosions occur when the laser energy is absorbed by water and the volume suddenly increases 800 to 1,000 times. This causes the formation of very small bubbles, micro-bubbles, which collapse again just fractions of seconds later. The thermal effect, which is obligatorily presupposed when a fluid acting as medium, is limited to a micrometer-thin layer on the root canal surface. Therefore, the exposure of tooth substance to excessive thermal effects that has been observed and feared with other laser applications is excluded.

I have been working with the Morita AdvErL Evo (Fig. 1) in my practice since 2015. This laser also is based on the principle of Laser-activated irrigation (LAI) and uses the formation of microbubbles to activate the irrigants, even if the term PIPS is not used for reasons of patent law.

In the course of time, the Morita AdvErL Evo has become an obligatory part of our treatment protocol, especially for the following procedures:

1. Cleaning the access cavity, representation of the root canal entrances.
2. Opening root canals, obtaining patency.
3. Removal of blockages.
4. Cleaning the root canals, removing the smear layer.
5. Removing calcium hydroxide, removing any foreign bodies.

Although the manufacturer offers a large selection of laser tips, two different tips have proven particularly well suited for endodontic treatments

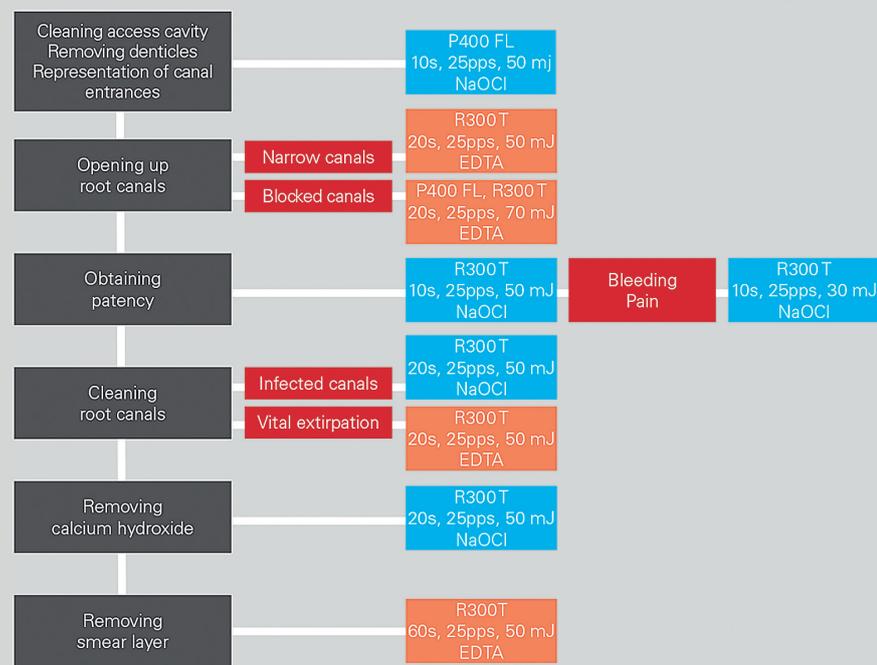


Fig. 2

and are used as part of my workflow (Fig. 2) in every endodontic treatment. The P400FL tip (Fig. 3) is designed for cleaning the trepanation cavity. Furthermore, in view of its diameter of 0.4 mm, length of 13 mm and curved attachment, it allows instrumentation of the coronal and, if necessary, middle sections of the root canal. The R300T tip (Fig. 4), which has a diameter of 0.3 mm and a length of 16 mm, can be used for accessing deeper areas of the root canal after preparation has been completed.

Fig. 2: Clinical workflow of LAI within the scope of endodontic procedures.

### Clinical workflow of LAI within the scope of endodontic treatments

Below I would like to describe in detail a clinical workflow:

#### 1. Cleaning the access cavity, representation of the root canal entrances

After the initial dental trepanation, the P400FL tip with 25pps and 70 mJ is used. Dentine splinters, which are pressed into the innumerable cracks and pores during the preparation of the access cavity and cannot be removed by conventional irrigation methods, can be removed in this way. After just a few seconds, the laser will have cleaned the access cavity

Fig. 3: The P400FL tip primarily is used for cleaning the endodontic access cavity as well as the upper and middle sections of the canal.

Fig. 4: The R300T tip can also be used deeper in the root canal and is helpful when cleaning the middle and apical sections of the canal.

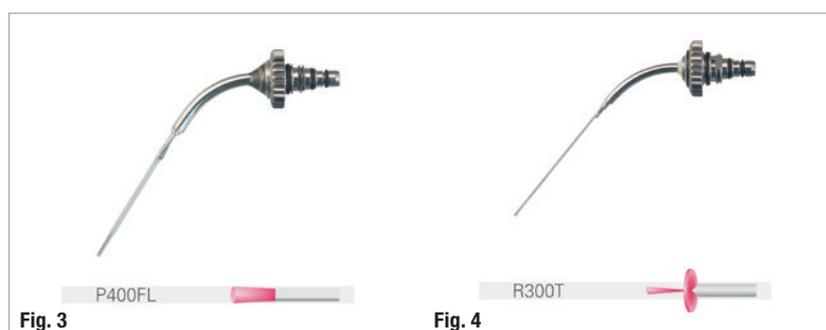


Fig. 3

Fig. 4

(Figs. 5 & 6). Any denticles will be detached from the soft tissue surrounding them and rinsed out, any soft- and hard-tissue will be removed from occult canal entrances, making them visible and penetrable.

## 2. Opening root canals, obtaining patency

Using Morita's AdvErL Evo will prove its worth particularly in very narrow canals, which involve a high risk of iatrogenic blockage. Morita's AdvErL Evo will rinse out the canals. Whereas the P400FL tip (25 pps, 50 mJ) is used before the initial opening, the R300T tip (25 pps, 50 mJ) is used for 20 seconds respectively after the coronal preparation of root canals. In this way, it will be significantly easier and foreseeable to open up root canals completely with thin manual instruments or mechanical glide-path instruments up to the foramen apicale within the meaning of the 'patency' concept. If the irrigation solution exhibits slightly red colouring, this indicates that there may be a patency. If there is stronger bleeding, even if it stops on its own just a short time after the laser instrument is used, the energy parameter should be reduced from 50 to 30 mJ. In the same way, periapical sensations of pain, which may occur sporadically to a minor degree, can be considered a sign that patency has been achieved and the energy parameter should be reduced to 30 mJ.

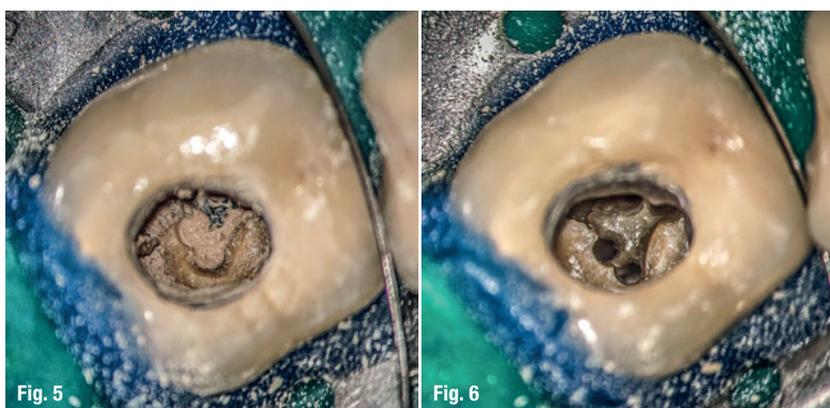
## 3. Removal of blockages

If there are any blockages, as can frequently be the case in revisions of the root canal filling, the P400FL and R300T tips are used at 25 pps and 70 mJ and, if necessary, with several irrigation cycles of 20 seconds respectively.

## 4. Cleaning the root canals, removing the smear layer

Following the initial opening of the root canals and the use of mechanical nickel-titanium instruments to complete the root canal preparation, if necessary also intermittently during the preparation, Morita's AdvErL Evo laser is used to remove the smear layer analogous to conventional irrigation of the root canals with irrigation solutions, ultrasound or sound-activated irrigation.

**Figs. 5 & 6:** The endodontic access cavity can be cleaned efficiently with Morita's AdvErL Evo.



Then the R300T tip with 25 pps and 50 mJ is used. The cloudiness of the irrigation solution after activation and the removal by rinsing of suspended particles clearly demonstrates the efficiency of the measures taken. This is particularly impressive if the conventional irrigating methods mentioned above were applied for the recommended duration in the root canal and, nonetheless, the laser still removes a smear layer from the root canal when it is applied afterwards. The cloudiness of the irrigation solution is a good indication for determining the duration of irrigation, which can be ended when the irrigation solution that is transported out of the root canal seems to be clear. As a rule, this should be the case after about 15–20 seconds.

In the event of bacterial infections, 3% NaOCl is used for the LAI; in the case of vital extirpation, 17% EDTA should be used.

## 5. Removing calcium hydroxide, removing any foreign bodies

As helpful as calcium hydroxide may be when it is used as an agent for disinfecting bacterially infected root canals, it is also difficult to completely remove this pasty material from root canals. Within the scope of endodontic treatments, I insert calcium hydroxide in the root canals as a medicinal filling after the mechanical preparation has been completed but before the root canal filling is inserted. It remains there for several days; in the case of large apical bright spots, it may stay 12 to 16 weeks so that we can verify by means of X-rays that reossification, a visible sign of healing, has started before we fill the root canal.

Before filling the root canal (Figs. 7–9), the calcium hydroxide has to be removed from the root canals. To this end, the mechanical apical master file is used to proceed up to 1 mm before reaching the working length to be able to remove as much of the pasty calcium hydroxide as possible by using the instrument's spiral-shaped teeth like a screw conveyor.

This is followed by a sound-activated irrigation using an EDDY attachment (VDW). Each root canal is rinsed for one minute with EDTA irrigation solution and sound activation. Afterwards, an XP-endo shaper instrument (FKG Dentaire) is used up to 1 mm before reaching the working length; however, the instrument is used less for preparation than for cleaning the walls of the canals mechanically. It seems reasonable to expect that there would be no more calcium hydroxide after such a time- and material-intensive manner of proceeding. So, it is highly impressive when Morita's AdvErL Evo laser transports a surprisingly large quantity of remaining calcium hydroxide out of the root canals. It is equally impressive to see that irrigating with Morita's AdvErL



**Figs. 7–9:** Side canals and ramifications that became visible in radiographs demonstrate how effectively root canals and even very fine structures can be cleaned within the course of a root canal treatment.

Evo laser may, in certain cases, even bring to light fractured foreign bodies such as fragments of instruments or irrigation tips as well as old filling material hidden in the depths of the root canals.

## Summary and evaluation

Progress in endodontics can be measured by the circumstance whether procedures are simplified or more cost-effective than previously. Or whether one can do something better. The Morita AdvErLEvo laser helps us improve our treatment in the different stages of a root canal procedure described above. Although I still take a negative standpoint towards many statements made about the use of lasers, I have a positive opinion about using an Er:YAG laser for LAI.

Critical aspects are the purchase price and the operating costs. The Morita AdvErLEvo laser is equipped with comparably fracture-proof attachments; although this property is desired for the product, it is not necessarily a matter of course in view of the alternatives that are available. Nonetheless, it must be borne in mind that the laser attachments, being the tools that they are, are subject to wear and, hence, have a limited service life. For this reason, the purchase price, operating costs and time involved, need to be taken into consideration when putting to-

gether a viable economic concept. Unfortunately, private health insurance schemes frequently refuse to pay for LAI treatments, even though German legislation added such innovative measures to the Schedule of Fees for Dentists. Of course, this is nothing new. For years, private health insurance companies refused to assume the material costs for disposable mechanical NiTi instruments or the costs for using a dental microscope within the scope of endodontic treatments. We can only hope that legislation will support the use of LAI in the near future. Irrespective of that, the practical benefits provided by Morita's AdvErLEvo laser are evident. For this reason, using the Morita AdvErLEvo laser for LAI has proven its worth as a meaningful and, hence, indispensable treatment measure in all different phases of root canal treatments and my endodontic work.

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## Kurz & bündig

Gegenüber konventionellen Methoden, die in der Endodontie bisher Verwendung fanden, schien der teure Laser für den Autor nie einen Mehrwert zu bieten. In den vergangenen zwei Jahrzehnten hatte sich auf dem Gebiet der Endodontie auch viel getan: NiTi als Material für mechanische Wurzelkanalinstrumente revolutionierten die Bearbeitungsprozeduren, auch die elektronische Längenmessung, dentale Mikroskopie, DVT und Ultraschall wurden etabliert. Ein weiterhin ungelöstes Problem stellte allerdings immer noch die Reinigungsqualität der Präparationsverfahren bei Wurzelkanalbehandlungen dar. 2014 kam der Autor mit der sogenannten PIPS-Methode in Kontakt, bei der ein Er:YAG-Laser zum Einsatz kommt. Diese Laseranwendung basiert nicht auf dem bis dahin gängigen thermalen Effekt, sondern auf Mikroexplosionen: Elektromagnetische Strahlung wird mit einer Wellenlänge von 2.940 nm, welche ideal durch Wasser absorbiert wird, emittiert. Der Laserstrahl regt die Wassermoleküle an, wodurch diese ihr Volumen stark vergrößern und Mikroexplosionen erzeugen. Auf diese Weise ist eine minimalinvasive und hitzearme Behandlung möglich. Seit 2015 arbeitet der Autor nun mit dem Morita AdvErLEvo, welcher auf dem beschriebenen LAI-Prinzip (Laser-activated irrigation) beruht. Besonders bei der Reinigung von Zugangskavitäten, der Eröffnung von Wurzelkanälen, der Entfernung von Verstopfungen, der Reinigung von Wurzelkanälen sowie bei der Beseitigung von Calciumhydroxid und Fremdkörpern hat sich dieser Er:YAG-Laser bewährt und ist ein hilfreiches Werkzeug in seiner endodontischen Arbeit geworden.