# LAI

## Using the Morita AdvErL Evo laser for endodontic treatments

Dr. Hans-Willi Herrmann

# Introduction

For more than 100 years, dental professionals have been observing the so-called „Endodontic Triad", which states that adequate preparation, disinfection and filling of the root canal system are necessary in order to ensure successful root canal treatments.

Enormous progress was made in the field of root canal preparation and filling during the past two decades. However, contrary to the steps mentioned before, less attention was paid to the field of disinfection and cleaning.

Micro CT studies, on the one hand, have shown the limits of mechanical canal preparation due to the innumerable root canal surfaces that cannot be accessed mechanically, and, on the other hand, the negative effects of removing material because of the debris and smear layers that are unfortunately collected in the complicated ramifications, side canals and isthmuses of the root canal system. As a result of these findings and the prevalent limits, cleaning and disinfection started to gain attention again.

New irrigation solutions and innovative cleaning processes have been developed. Ultrasonic cleaning has been supplemented by acoustic-induced activation of irrigation solutions (EndoActivator, Eddy) and the SAF system that files in micro-stroke movements. What all these solutions have in common is that the mechanical activation of the irrigation intensifies the cleaning results.

**L**aser **A**ctivated **I**rrigation takes a different approach, as is described by the term Photon Induced Photoacoustic Streaming (PIPS)[1].

This type of laser application, which uses an Erbium:YAG laser with an effective wavelength of 2,940 nm, is no longer based on a direct thermal effect; instead, the endodontic irrigation solutions are activated by small gas bubbles that form on the laser tip as a result of the development of heat. As they move away from the tip, they cool down and collapse. In this way, 50 bubbles per second are formed in quick sequence; they form a chain of air bubbles that wander through the solution, pressing it into the ramifications of the root canal system and the dentinal tubules. Up until now, this was not possible in an adequate manner with the options available, be it 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, microbubbles, which collapse again just fractions of seconds later. The thermal effect, which is obligatorily presupposed in connection with a fluid acting as medium, is limited, if it occurs at all, to a micrometer-thin layer on the root canal surface. Therefore, the exposure of tooth substance to excessive heat that is known and feared from other laser applications is excluded.

[1] DiVito E1, Lloyd A. ER:YAG laser for 3-dimensional debridement of canal systems: use of photon- induced photoacoustic streaming. Dent Today. 2012 Nov;31(11):122, 124-7.

Just like the Lightwalker laser, Morita's AdvErL Evo laser (Fig. 1) applies the principle of **L**aser **A**ctivated **I**rrigation (LAI) and forms microbubbles to activate the irrigation solution, even if the term PIPS is not used for reasons of patent law.

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

The following endodontic treatment steps are possible when using Morita's AdvErL Evo laser:

1. Cleaning the endodontic access cavity, representation of the root canal entrances
2. Opening up root canals, removing any blockage
3. Obtaining patency
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 21 laser tips, two different tips have proven particularly well suited for endodontic treatments. The P400FL tip (Fig. 2) 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 root canal sections. The R300T tip (Fig. 3), 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. Even though other attachments are available for root canal treatments, e.g. tips R200T and R135T, which are even thinner and suitable for working in narrow root canals, as well as attachments designed to ensure efficient cleaning of the endodontic access cavity (e. g. R600T, C400F), endodontic treatments can be carried out satisfactorily with the two tips mentioned first, without having to accept limitations in everyday dental work.


Fig. 2
The P400FL tip primarily is used for cleaning the endodontic access cavity as well as the upper and middle sections of the canal

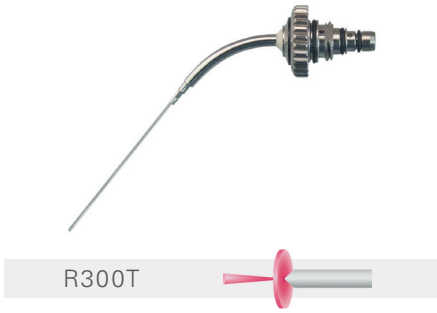


Fig. 3
The R300T tip can also be used deeper in the root canal and is helpful when cleaning the middle and apical sections of the canal

In combination with the available laser tips, the slim handpieces, designed like ultrasonic scalers and completely sterilizable on the inside and outside (Fig. 4), allow a direct view of the region of interest because the dentist can look past the tip of the instrument and the, de facto non-existent, instrument head. The laser light is supplied via a goose-neck glass-fiber arm (Fig. 5), which allows an ergonomic workflow with significant freedom of movement and contributes to the very low weight of the overall construction. This ergonomic feature is helpful not only when one works with a dental microscope but generally during any treatment.

Fig. 4
The slim handpiece of AdvErL Evo allows a direct view of the region of interest

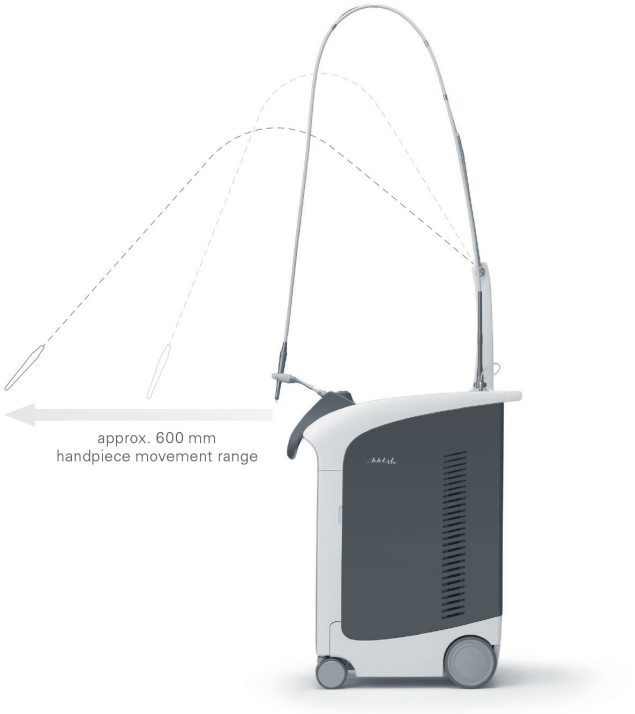


Fig. 5
The laser light is supplied via a goose-neck-shaped glass-fiber arm, which allows ergonomic workflow with considerable freedom of movement

# Clinical workflow of LAI within the scope of endodontic treatments

Below I would like to describe in detail a clinical workflow (Fig. 6):

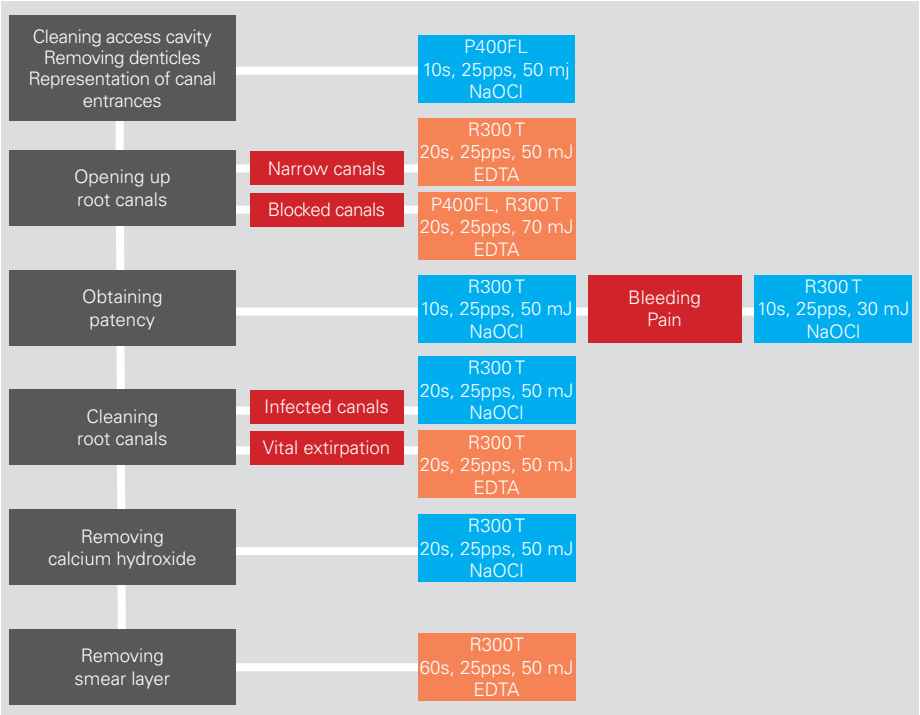


Fig. 6
Clinical workflow of LAI within the scope of endodontic procedures

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

   After the initial dental trepanation, the P400FL tip with 25 pps and 70 mJ is used. Dentin 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. 7, Fig. 8). 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 coloring, 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 mJ should be reduced to 30 mJ.

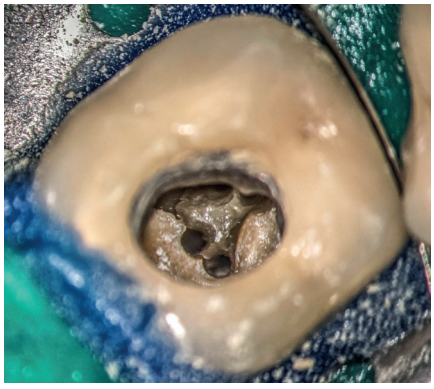

Fig. 7, Fig. 8
The endodontic access cavity can be cleaned efficiently with Morita's AdvErL Evo.

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.

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

   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.

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. When it is used as a medicinal filling, the author, before filling the root canal, uses a mechanical apical master file to proceed up to 1 mm before reaching the working length so as to be able to remove as much of the pasty calcium hydroxide as possible, i.e. like a "spiral conveyor". This is followed by sound activated irrigation using an Eddy attachment (VDW, Munich). Every root canal is rinsed for 1 minute with EDTA irrigation solution and sound activation. Afterwards, an XP Endo shaper instrument (FKG, La Chaux-de-Fonds) 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 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

The role of root canal cleaning within the scope of endodontic procedures has been gaining the increased attention of dental professionals since the shortcomings of convention methods are becoming more and more evident. As an innovative cleaning method, **L**aser **A**ctivated **I**rrigation with Morita's AdvErL Evo laser leads to better cleaning and disinfection results. This has been demonstrated in evidently clean cavities as well as by an increase in filled ramifications shown in X-rays (Fig. 9, Fig. 10, Fig. 11). For this reason, I recommend using the Morita AdvErL Evo laser for endodontic procedures as a meaningful treatment measure in the different phases of a root canal treatment.

Fig. 9, Fig. 10, Fig. 11
Side canals and ramifications that became visible in X-rays demonstrate how effectively root canals and even very fine structures can be cleaned within the course of a root canal treatment

# About the Author

Clinical images and content provided by:

**Dr. Hans-Willi Herrmann**

Specialist in Endodontology of the German Society of Endodontology and Traumatology

Certified Member of the European Society of Endodontology

Dr. Herrmann ist working in private practice limited to endodontics.

**Dental Vita**

Since 1997 he has given more than 350 lectures nationally and internationally on endodontic topics.

Dr. Herrmann is on the advisory boards of the endodontic magazines „Endodontie“ and „Endodontie Journal“ and has written many articles on endodontic topics as well as book chapters for endodontic text books like Thieme´s „Color Atlas of Endotontology“ , Quintessence´s „Problems in Endodontics“ and Quintessence´s „O Movimento Reciprocante na Endodoncia“.




For more information, please contact Frank Wirtz under +49.160. 705 818 4.