Material and methodology

Polarizing laser light decontaminates oral cavity, for exposing implants and/or removed teeth. It was proven in these applications that especially a Gram-negative, anaerobic germ spectrum is sufficiently damaged by the laser light.

The following paper describes—by means of three selected patient cases—our "Freiburg" experience of incorporating laser light decontamination in the therapy of marginal periodontopathies.

Material and methodology

We are presenting treatment results for three patients who received dental treatment over a period of 15 years (12/94-04/10). Initially, these three patients suffered from a profound marginal periodontopathy with inadequate degeneration of supportive tissue. The course of treatment for these three patients proceeded according to the following regimen:

1. Initial therapy (12-1994 through 01-1995)
   - Motivation and instruction of the patient
   - Cleaning and polishing
   - Application of disinfecting agents

2. Resective phase (01-1995 and/or 02-1995)
   - Creation of a mucoperiosteal flap
   - Removal of granulation tissue
   - Decontamination with diode laser light (p=1.0 Watt; tmax=20 sec)
   - Apical shifting of soft tissue
   - Reconstructive phase (01-1995 and/or 02-1995)

The distinct advantage of an orthopantomogram is its panoramic view of all teeth, the osseous limbus alveolaris and important adjacent anatomic structures. By comparison, dental film images as a parallel technique provide information about the progression and stagnancy of the issue degeneration, because they enable statements about the behavior of the limbus alveolaris.

Microbial diagnostics

At the time of diagnostic radiology (see above), germ extractions of the affected areas were also performed. This was not done by way of the conventional microbial examination technique (germ extraction culture—pure cultures—microscopic specimen—gas chromatography—sensitivity to antibiotics and color test strips), instead, DNA-RNA hybridization tubes were used.

The advantage of these hybridization tubes was that no live material from the probed areas was required for cultivation, thus reducing work in the dental practice. In addition, the results were available much faster than with the classic microbial examination technique. The disadvantage of these rapid tests is a relatively high price and the fact that the examined germs and evaluated the so-called marker germ values.

The result was considered negative if less than 0.1 % was identified as a marker germ. The result was considered to be low if 0.1-0.99 % was identified as a marker germ. The result was considered to be medium if 1.0-9.9 % was identified as a marker germ and high if more than 10 % was identified as marker germ.

Dental light decontamination

Decontamination was an essential part of the overall therapy. It was achieved with diode laser light of 810 nm wavelength, 1 WATT of power and an application time of 20 seconds per tooth and implant under fiber contact.
in continuous wave mode. When adhering to these parameters (time limitation and power limitation) it can be guaranteed that the germ spectrum causing the disease can be sufficiently damaged and at the same time that pulpa and/or peri-implant or peri-odontal tissue structures do not suffer any thermal damage (Bach and Krekeler [1994]).

Three patient cases 1995/2010

Three patients are presented from the original patient group of the “diode laser basic study” (25 patients) from 1995 (Krekeler/Bach, Department of Parodontal Surgery of the University Dental Clinic, Freiburg/Breisgau) who showed typical progression patterns and whose treatment illustrates the advantage of integrating diode laser light application into a proven therapy regimen for the treatment of marginal periodontopathies.

CASE 3

Fig. 15, Panoramic tomography taken in 1995 (commencement of treatment).
Fig. 16, Initial X-ray image taken in 1995.
Figs. 17-19, Baseline findings in 1995.
Fig. 20, Four-year follow-up 1999.
Fig. 21, Panoramic tomography taken in 2004; dental implants were inserted to increase the number of abutment teeth.

Fig. 22, X-ray image dating back to 1994 (requested by a previous dentist).
Fig. 23, Panoramic tomography taken in 1995 (commencement of treatment).
Figs. 24 & 25, Initial clinical images dating back to 1995.
Fig. 26, Follow-up X-ray image taken in 2001 (6-year follow-up).
Fig. 30, 11-year follow-up in 2006.

Diagnosis

Most severe form of adult marginal periodontitis having portions with a fast-course component.

Course of treatment 1995–2010

Tooth 37 was extracted within the scope of initial pain treatment, as were teeth 26, 17 and 51. Removable immediate prostheses were incorporated because all three pontic reconstructions had to be destroyed during the extraction therapy. The pretreatment phase proved to be unproblematic; the patient was very motivated and eager to learn the oral hygiene techniques as instructed.

Clinical baseline findings (1995)

Abduction tooth 17 showed a degree of loosening of 2, as did tooth 26 and tooth 45. Mental probing resulted in produce, hard to arrest bleeding. BOP and high probing depths were found in general. The interdental spaces had soft deposits, also under the pontics.

X-ray diagnosis (1995)

The panoramic tomography (orthopantomogram) shows severe horizontal and vertical bone lesions. Teeth 55 and 26 have dish-shaped defects. Trifurcation 54 is opened radiologically

From June to August 1995 the remaining teeth were treated with open curettage. She had no recurrence for a long time. She received implants in the third quadrant while the remaining maxillary side teeth received fixed prostheses. The edentulous space in the second quadrant remained at the patient’s request; in the first quadrant, the principle of a shortened row of teeth was realized (up to 5’ to 5th).

This condition was maintained from the end of 1996 to 2008. The patient conscientiously observed all recall appointments. Aside from the usual cleaning, motivation and instruction steps, a diode laser light application was always performed. Special emphasis was placed on the periodontally severely damaged premolars and the remaining molar 27.

First re-inflammations of the marginal periodontopathy were noticed in 2006. A re-ablation of teeth 14, 15 and 27 was performed once again. Due to sub-luminal but latent discomfort, teeth 15, 14 and 27 were removed at the beginning of 2010 and a new concept for treatment of the maxilla was developed.

A removable telescopic prosthesis (cuspids are abutment teeth) was incorporated. The prosthesis on the mandible, which has been in place for 15 years, is still there, and there are no signs of a degeneration of the supportive tissue on the natural and artificial abutment teeth.

Epiphenomena

Very remarkable in this patient was the considerable amount of trust she had—in spite of bad experiences in the past—in the new laser-assisted therapy concept, which was out of the ordinary at the time. Her compliance was exceptionally good for the entire 15 years. Because of her conscientious oral hygiene and strict adherence to the recall system she remained recurrence-free for more than a decade. This still holds true for the mandible, while the attendent massive degeneration of supportive tissue required the removal of three maxillary teeth. Thanks to the diode laser-assisted periodontal therapy and the continuous recall, the patient was able to retain the majority of her teeth in the maxilla and the fixed prostheses for a longer period of time. It was only recently that this concept in the maxilla had to be modified in favor of a removable one; however, this occurred 15 years after a similar suggestion (removable prosthesis) had been made by her attending dentist at the time.

X-ray diagnosis, stating that he was completely healthy.

Fig. 27, The panoramic tomography taken in 2010 does not show any signs of progressive degeneration of the supportive tissue; the image rather shows a “stable osseous condition.”
Figs. 28-30, Clinical images taken in 2010. In the frontal view as well as in the lateral views and both jaw views conditions without irritations prevail for the most part.

Fig. 16, Panoramic tomography (orthopantomogram) shows severe horizontal and vertical bone lesions. Teeth 55 and 26 have dish-shaped defects. Trifurcation 54 is opened radiologically

Fig. 18, X-ray image taken back to 1994 (requested by a previous dentist).
Clinical baseline findings in 1995

Teeth 27 and 57, 58 showed a degree of loosening of I–II. The side teeth showed increased probing depths, and a BOP was detected in general. The front mandible was found to be without irritation. The interdental spaces had soft deposits. There were edentulous spaces 16, 15, 26, 27, 45, 46, 55, 56.

X-ray diagnosis (1995)
The X-ray treatment orthopantomogram shows an adult dentition with general horizontal bone loss and profound vertical bone losses on the following teeth: 17, 14, 27, 47 and 48. The patient had to retain recurrence-free cast restorations. Tooth 24 shows two apical radiopaque structures on the root apex and a discrete periradicular translucent zone.

Diagnosis

Adult marginal periodontitis.

Course of treatment 1995–2010

The entire pre-treatment phase proved to be without complications due to the patient's initially high compliance. The teeth of the maxilla and the mandible were treated with a mixed open (interdental area) and closed (front-tooth area) curettage in the subsequent surgical phase. The surgical part of the periodontal treatment was completed in April of 1995. Since then the patient has been in the recall system, which he took very seriously and which helped him to remain recurrence-free for four years after the surgical treatment. From 1999 to 2005 the recall started to become difficult because the patient did not show up in spite of appointments or rescheduled appointments on short notice. In 2005 increased probing depths were found on 25, 24 and 27 and three additional teeth exhibited bleeding when probed. Another curettage with laser light decontamination resulted in a decrease of the inflammation; however, 27 could not be saved and had to be extracted, as did tooth 24 (condition after root apex resection), which fractured subgingivally. The resulting free-end situation starting with tooth 25 in the left half of the maxilla and the existing edentulous space in the right half of the maxilla, which had been there for a longer period of time, were treated with three implants that received crowns after a three-month osseointegration period. We arranged with the patient that he should participate in a quarterly recall and make a new appointment upon completion of the respective recall. He has been recurrence-free since then.

The X-ray images showed a marked tendency for reduction of the osseous structures around the crowns on tooth 24. (Note: This tooth was also extracted.) None of the other teeth showed any substantial changes in the course of the osseous limbus alveolaris. The implants also did not show any changes of the periimplant osseous condition from the time of insertion up to the present day.

Epiprisis

Our prognosis after removal of the non-conservable teeth and the systematic increase of abutment teeth is very favorable. The patient's compliance—after variations in the medium observation period—is stable and good. The long recurrence-free interval is also very gratifying.

3rd Case (Figs. 25–34)
The "completely delightful long-term patient" Male patient, born in 1952.

Medical history

This patient had been with the same dentist for many years, whom he consulted for check-ups on a regular basis. The patient was surprised to find that his teeth 12 and 11 were "loose" and had to be extracted. He was then referred to our clinic. The patient was quite obviously unhappy with the loss of two teeth and the referral ("I feel pushed off"). He is a physical education teacher at a high school and stated that he was completely healthy.

Clinical baseline findings (1995)

Almost all teeth revealed increased probing depths, and probing on the gums in the side-tooth area resulted in bleeding. The smooth surface cleaning was very good; however, deposits were found in the interdental spaces. The dental necks of the maxillary premolars showed wedge-shaped defects. The patient had received primarily cast restorations.

X-ray diagnosis (1995)

In the maxilla, the osceous limbus alveolaris has a considerably reduced level. The alveolar ridge in the area of the tooth gap 12, 11 is severely atrophied. Bone mass in the mandible is also reduced, although not as extensively as in the maxilla. Tooth 45 had received a root canal treatment. The crown edges of the cast restorations do not align perfectly with the contour of the teeth and mostly have an overhanging design.

Diagnosis

Severe adult marginal periodontitis.

Course of treatment 1995 to present

Our most difficult task initially was to appease the patient's dissatisfaction because he felt he "had been taken for a ride." After we had successfully done that, the patient eagerly followed our instructions and followed a frequent and sufficient oral hygiene regime. He grew especially fond of interdental cleaning which had never been mentioned to him before. In May 1995 we started the corrective phase, which was completed in July. We carried out lobe surgery with apical soft tissue fixation in all quadrants. The patient received two implants in regions 12, 11, and after their osseointegration, two blocked crowns. Due to the severe bone degeneration and the patient's wish to forego augmentation, we arrived far below the cement-enamel junction of the adjacent teeth in one oral implant; however, this did not pose a problem due to the patient's extremely deep-set upper lip. The patient has been in our recall system for 15 years now; he has not missed one recall appointment and has been recurrence-free ever since. A successive prosthetic treatment of some single (component) crowns, which had become insufficient, was carried out over the course of several years.

Epiprisis

I feel that—on the "credit side"—we have the patient's excellent cooperation, which has not diminished to this day, and the long recurrence-free period. In this context, one should not forget the extent of the previous periodontitis. These aspects leave a very satisfying impression.