Diode laser surface decontamination in periodontitis therapy

15 years of incorporating

Author_Dr Georg Bach, Germany

CASE 1

Fig. 1_Panoramic tomography (emergency service) dating back to 1995—immediately prior to commencement of treatment.
Fig. 2-4_Baseline findings in 1995.
Fig. 5a & b_Tooth 37 was not conservable in spite of hemisection (August 1995), resulting in a large edentulous space in the third quadrant (November 1995).

_We don't always have the opportunity to provide long-term dental treatment for patients with a profound marginal parodontopathy who have undergone resective surgical therapy, at times including reconstructive work. Correspondingly, there is only a limited amount of literature available due to the aforementioned fact. The number of published studies/other publications is even more limited as regards new therapy concepts or adjuvant treatments to complement a proven therapy regimen. In 1995, the first diode laser (wavelength 810 nm) was presented at IDS in Cologne. This device—initially as a prototype—had been used within the scope of a test phase since 1994. At the end of 1994 patients were treated with this "new" laser wavelength for the first time, which had not been used in dentistry up until that time. The Freiburg laser work group led by Krekeler and Bach, who were the first ones to deal with the integration of diode laser light in dentistry, noticed the considerable advantages of this new technology.

High-performance diode lasers emit monochromatic coherent light at a wavelength of 810 nm. This light is absorbed particularly well by dark surfaces. Thus the injection laser (= diode laser) is ideally suited to perform cuts, as are com-

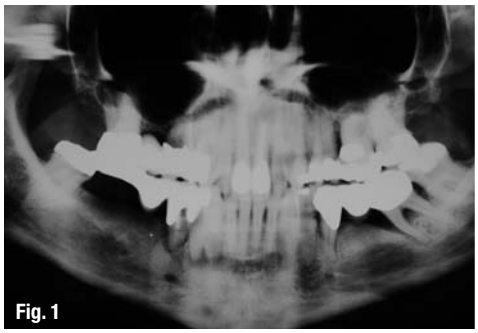

Fig. 1

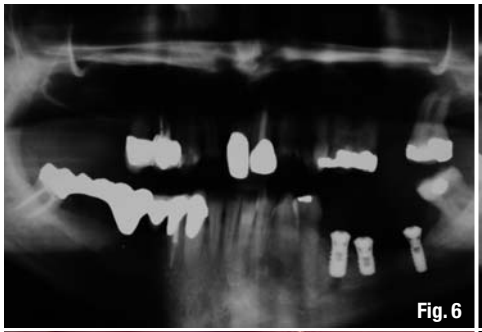

Fig. 2


Fig. 3


Fig. 4


Fig. 5a


Fig. 5b


Fig. 6

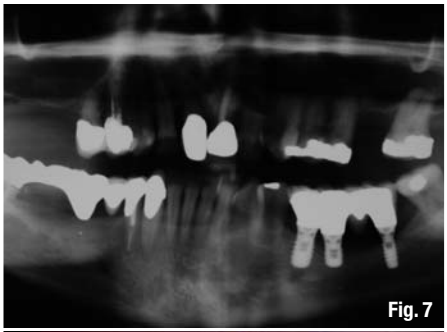

Fig. 7


Fig. 8


Fig. 9


Fig. 10


Fig. 11

mon in dental surgery, as well as for the removal of benign tumors in the oral cavity, for exposing implants and for use in mucogingival surgery. This excellent cutting performance of the diode laser can be attributed to the exceptional absorption of the laser light by the hemoglobin in the tissue. Aside from an application in soft-tissue surgery, the diode laser is also used for decontaminating surfaces that are colonized by germs (on implants and 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 parodontopathies.

_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 parodontopathy 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; t_{max} = 20 sec)
_Apical shifting of soft tissue

3. Reconstructive phase (01-1995 and/or 02-1995)
_Bone augmentation, if required
_Mucogingival corrections, if required

4. Recall phase (from 05-1995 to present)
_After 4 weeks, 6 months, 1 year and then annually: complete survey of clinical evidence, X-ray diagnosis, repeated decontamination with diode laser light of exposed root areas, if required.

_Imaging procedures

As a general rule, the orthopantomogram (panoramic tomography) and in special cases/as a supplementary measure dental film images as a parallel technique were the applied imaging procedures.

A-scan and B-scan ultrasonography was also used in a few cases of exacerbated inflammations. An orthopantomogram was taken preoperatively and immediately post-operatively, and a panoramic tomography every three years thereafter.

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.

Fig. 6_Orthopantomogram after insertion of 3 short implants ("shorties") in the atrophied left half of the mandible.
Fig. 7_6-year follow-up in 2001.
Fig. 8–11_Clinical findings in 2009, shortly prior to restoration of the maxilla (general view and details).

_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—cultivation—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. The disadvantage of these rapid tests is a relatively high price and the fact that the employed product only detects special marker germs so that not all microbial organisms in the sulcus can be identified.

The area where a germ extraction was planned had to be carefully dried with a cotton swab. The paper tip was then put in place and, after an exposure time of 10 seconds, was immediately packaged in a sterile container and forwarded to the manufacturer for germ identification. The manufacturer identified the 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 marker germ and high if more than 10 % was identified as marker germ.

_Laser 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 periodontal 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 parodontopathies.

_1st Case (Figs. 1–14)

The holding therapy case

Female patient, born in 1954.

Medical history

The patient went to the Sunday emergency service at the Freiburg dental clinic because of pain in tooth 37. A profound parodontopathy was diagnosed there, and the patient came to our department on the following Monday requesting treatment. She had received a complete fixed restoration from her dentist 6 months ago, but without a preprosthetic X-ray diagnosis. Ms. D. is a healthy and very health-conscious physiotherapist.

Clinical baseline findings (1995)

Abutment tooth 17 showed a degree of loosening of 2, as did tooth 26 and tooth 45. Mesial probing resulted in profuse, 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 le-

Fig. 12_The periodontal lesions (vertical bone degeneration) on teeth 15, 14, 24, 25 are so advanced that these teeth can be considered non-conservable.

Fig. 13 & 14_There are essential modifications in comparison with the baseline findings regarding the maxilla. Some teeth have to be extracted. Furthermore, a removable bridge (telescopic bridge) was inserted.

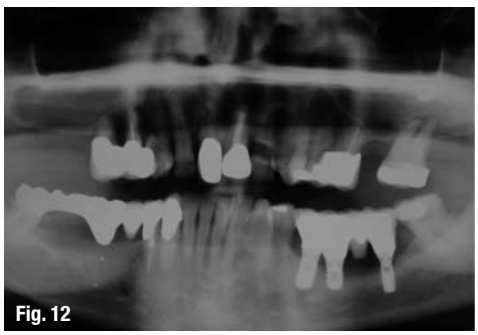
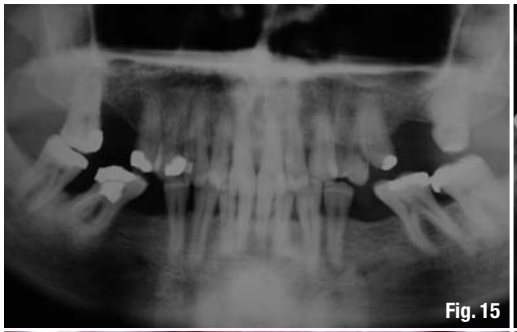

Fig. 12


Fig. 13


Fig. 14


Fig. 15

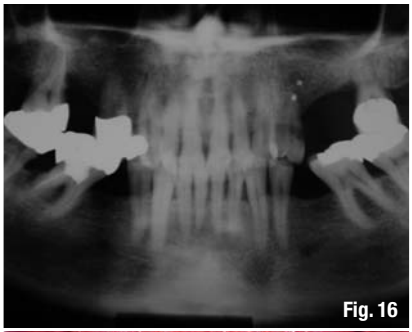

Fig. 16


Fig. 17


Fig. 18


Fig. 19


Fig. 20


Fig. 21

sions. Teeth 35 and 26 have dish-shaped defects. Trifurcation 34 is opened radiologically.

Diagnosis

Most severe form of adult marginal parodontitis 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 35. 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.

From June to August 1995 the remaining teeth were treated with open curettement. 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 parodontopathy were noticed in 2009; a curettement of teeth 14, 15 and 27 was performed once again. Due to subliminal 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.

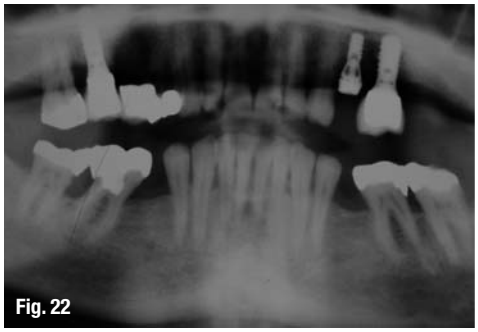
A removable telescopic prosthesis (cuspids are abutment teeth) was incorporated. The prosthesis on the mandible, which has been in place for 15 years, is still there, and there are no signs of a degeneration of the supportive tissue on the natural and artificial abutment teeth.

Epicrisis

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 antecedent 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

CASE 2

Fig. 15_Panoramic tomography dating back to 1994—prior to 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

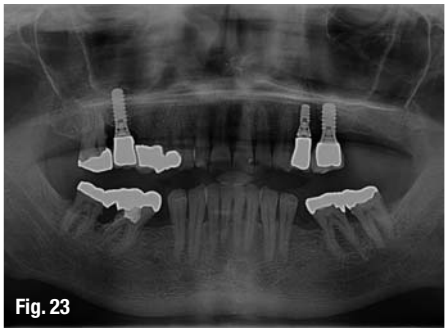

Fig. 23


Fig. 24

Fig. 22_The principle of increasing the number of abutment teeth is still being pursued twelve years after commencement of treatment (OPG dating back to 2007).
Fig. 23_Current panoramic tomography taken in 2010.
Figs. 24_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.

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.

_2nd Case (Figs. 15–24)

Success due to (laser-assisted) recall case

Male patient, born in 1938.

Medical history

This patient had been treated since childhood by a dentist who passed away in 1991. For some time the patient had been complaining of toothaches and bleeding of the gums, the latter also occurring spontaneously.

He consulted the successor of his former dentist at the dental practice. However, this dentist did not pay much attention to his descriptions (discomfort) and only remarked once that "there is nothing that can be done!". The patient had obtained the last OPG that had been taken and brought it to the initial examination at our clinic, but he refused (three months later at our clinic) a new X-ray diagnosis, stating that he was completely healthy.

Clinical baseline findings in 1995

Teeth 27 and 37, 38 showed a degree of loosening of I–II. The side teeth showed high 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, 25, 26, 27, 45, 46, 35, 36.

X-ray diagnosis (1995)

The panoramic tomography (orthopantomogram) shows an adult dentition with general horizontal bone loss and profound vertical bone lesions on the following teeth: 17, 24, 27, 47 and 48. The patient had received primarily cast restorations. Tooth 24 shows two apical radiopaque structures on the root apex and a discrete periapical translucent zone.

Diagnosis

Adult marginal periodontitis.

Course of treatment 1995–2010

The entire pre-treatment phase proved to be without complication due to the patient's initially high compliance. The teeth of the maxilla and the mandible were treated with a mixed open (side-tooth area) and closed (front-tooth area) curettement 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 initially and which helped him to remain recurrence-free for four years after the surgical treatment. From 1999 to 2003 the recall started to become difficult because the patient did not show up in spite of appointments or rescheduled appointments on short notice. At the beginning of 2003 increased probing depth were found on 23, 24 and 27 and three additional teeth exhibited bleeding when probed. Another curettement 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 23 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 supportive tissue 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 insertion up to the present day.

Epicrisis

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 osseous 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 re-treatment of some single (component) crowns, which had become insufficient, was carried out over the course of several years.

CASE 3

Fig. 25_X-ray image dating back to 1994 (requested by a previous dentist).

Fig. 26_Panoramic tomography taken in 1995 (commencement of treatment).

Fig. 27 & 28_Initial clinical images dating back to 1995.

Fig. 29_Follow-up X-ray image taken in 2001 (6-year follow-up).

Fig. 30_11-year follow-up in 2006.


Fig. 25

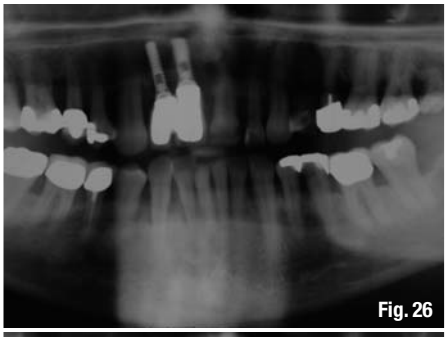
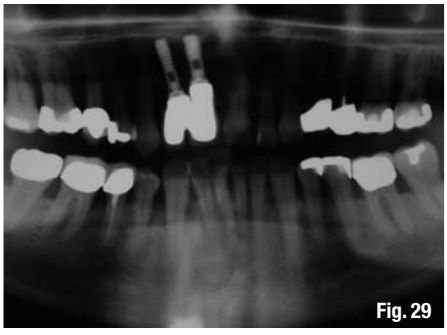

Fig. 26


Fig. 27


Fig. 28


Fig. 29

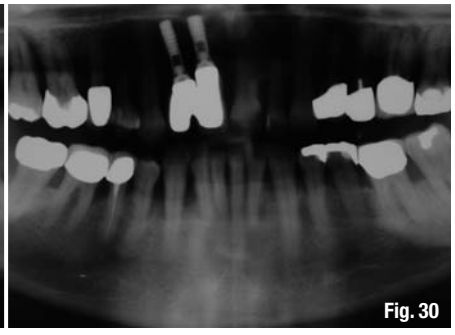

Fig. 30


Fig. 31


Fig. 32

Fig.31_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. 32–34_Clinical images 2010 (comprehensive and detail views) showing "reduced" but overall stable conditions. The condition of the mandible also appears normal, which is confirmed by the detail view of the frontal mandible.


Professor Dr Gisbert Krekeler

I would like to dedicate this paper to my academic instructor, Professor Dr Gisbert Krekeler (†). We owe it to his initiative that the option of diode laser decontamination and the introduction of diode laser into dentistry in general were made possible!

Epicrisis

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.

_Discussion

The diode laser decontamination study (Krekeler/Bach; University Dental Clinic, Freiburg/Breisgau) that started in 1994 and 1995 was made up of 25 patients, of which seven are still receiving treatment. The extremely long examination period (15 years) naturally limited the number of patients we could examine and treat. Some of the patients, who are no longer in our recall system, have unfortunately passed away in the meantime, while others have moved away or found a different dentist who is located closer to their new residence (usually a care home). Over the years, three "patient types" have emerged—the "holding therapy" type, the "imperative recall type to avoid being the unsuccessful type" and the "successful type". The purpose of this paper is to present these three types by way of individual examples. Diode laser light decontamination proved to be very helpful in all examined patients—I feel that, based on the current results, this assessment is justified because the incorporation of diode laser decontamination into the proven treatment regimen for periodontitis resulted in a considerable reduction of the recurrence rate and a considerable improvement of the prognosis of this disease.

An evaluation of the significance of the laser treatment, which has been established as an integral part of a proven therapy regimen in our treatment philosophy, is certainly worthy of discussion. Laser critics will want to argue that a close-meshed and consistent recall, possibly supported by other adjuvant measures, would have yielded similarly positive results. This may indisputably be the case; in fact, I am sure that this assessment is true!

However, if the key to treatment success is then rather the consistency and frequency of treatment, I consider laser-assisted treatment to be one of many options in the extensive field of periodontal therapy. Laser-assisted periodontal therapy thus makes no pretence of being a unique feature, but rather an adjuvant therapy with the claim to be efficient, gentle and ultimately successful._

_contact laser

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Fig. 33


Fig. 34

today

IDS 2011

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Great expectations — An interview with the executives of Koelnmesse and the Association of German Dental Manufacturers (VDDI). » page 2

Stanley M. Bergman speaks — The Chairman and CEO of Henry Schein about IDS and why international markets like Germany are key for his company's success. » page 18

New products in focus — Many products will be on display at IDS 2011. Get an overview about what the world's most innovative companies have to offer. » page 20

IDS 2011: another record breaker for dentistry

More than 10,000 visitors expected to attend the world's largest dental show in Cologne, Germany.

■ Visitors of this year's IDS in Germany should probably schedule more time to get hands on the latest advancements in dentistry. After the record breaking show in 2009, the number of exhibitors has increased again due to more foreign companies showing interest in becoming a part of the world's largest dental trade fair, the organizer Koelnmesse told today international.

The company expects over 1,800 dental companies from 56 countries to attend the exhibition. Due to the high demand, Hall 2 will be opened for companies and visitors for the first time, they said.

The additional requests for trade fair attendance mainly comes from companies active within the fields of implant restorations and digitalization. The number of companies exhibiting CAD/CAM system, for example, has increased by over 40 per cent compared to IDS 2009.

"The great level of participation from all over the world is attributable to the fact that the International Dental Show is the leading trade fair for the entire international dental world," Oliver P. Kobel, Executive Vice-President of Koelnmesse GmbH, summarized the exhibition concept.

Visitors swarm one of the halls at IDS Cologne 2009. (IDS/Photo Koelnmesse Germany)

According to Kobel, online business services will enable IDS visitors and exhibitors to get in touch with each other before the start of the show in March 2010. The product catalogue will be also revamped and presented with a new layout and improved search options. Owing to the growing popularity of mobile services, a free IDS app will be offered for iPhone, Blackberry and other mobile operating systems.

The 34th International Dental Show will be taking place at the Cologne exhibition center in Cologne, Germany, from 22 to 26 March 2011. In addition to the dental exhibition, there will be a substantial specialists programme supported by manufacturers, the German Dental Association and the Association of German Dental Technicians Guilds.

Advance sales tickets ranging from €7.50 to €13 are still available online on the Koelnmesse website (www.koelnmesse.de). ■

TBR PERIOSAVE—Protecting the periodont with an anti-bacterial shield

An interview with Julien Benhamou, CEO of TBR, about the company's new implant system

■ *During the International Dental Show 2011, TBR Group will present the PERIOSAVE implant system which guarantees an anti-bacterial protection of the periodont and fit to the clinical requirements of more than 20,000 TBR users worldwide.*

Mr Benhamou, how does the PERIOSAVE system protect the patient from peri-implantitis risks?

We decided to come back and focus on the basis of dental implantology which is to offer the patient a durable implant with the lowest risk of infection. Indeed, studies have proved that 9 to 14 years after implant placement, a risk of peri-implantitis occurs in 16 per cent of cases. A progressive loss of cortical bone happens which threatens the stability of the implant (Roos Jansäcker et al. 2006).

To avoid periimplantitis, and to provide a real anti-bacterial globalprotection for the implant, we have decided to utility and to develop several ranges of PERIOSAVE implants giving an answer to this main concern. For every indication, we propose an implant solution that provides surgeons with anti-bacterial safety and patients with a real aesthetics solution.

Julien Benhamou, CEO of TBR, France

The proposed implant solution must be adapted to the patient's anatomy and not the other way around. The dentist will be in a position to select the implant type according to the clinical case.

Can you give us a short introduction to the PERIOSAVE implants lines?

today » page 3

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