



“ In the industrialized
countries periodontal disease
affects approximately
60% of the population ”

It is high time this problem was tackled!



FotoSan® 630
LIGHT ACTIVATED DISINFECTION

“ Periodontitis is one of the most widespread chronic inflammatory diseases among the populations of western countries.

“ In the industrialized countries periodontal disease affects approximately 60% of the population, and 10 to 15% have advanced serious chronic or acute forms. The age range between 35 and 45 is the most seriously affected.



60%

Percentage of the population affected by periodontal disease

10-15%

Percentage with serious / chronic / acute forms

35-45 years

Most seriously affected age range

Periodontal diseases cause serious modifications with functional, and aesthetic defects. As periodontal diseases may go unnoticed by the individual and slowly develop, irreversible destruction of the periodontium is a common outcome.

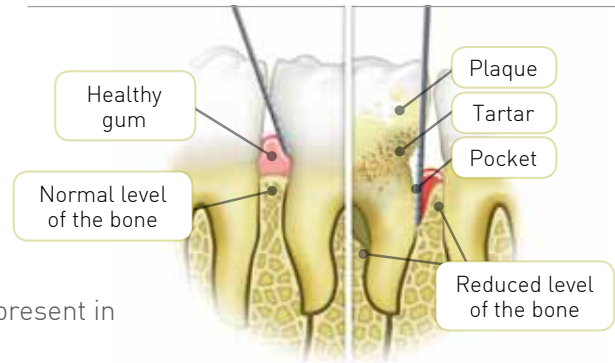
- **In industrialized countries, periodontitis is the main cause of partial or total edentulism.** The disease also has a significant negative psychological impact on the patients quality of life detracting from their smiling and laughing.
- **There is a close link between periodontal disease and lifestyle.** The onset of periodontitis has a multi-factor aetiology, in which bacterial plaque (and in particular some strains of bacteria) play a fundamental part, supported by the interaction of other co-factors such as the patient's genetic predisposition, systemic conditions, and lifestyle.
- According to the report by the World Health Organisation (WHO – 2002), some of these factors influencing the onset and progression of periodontitis can also determine **the development of serious systemic diseases**, with consequences on the quality of life and average lifespan of the population.
- **All this evidence stresses how important it is that clinicians should recognize, intercept and diagnose periodontal disease at an early stage in order to evaluate the correct preventive and/or therapeutic procedures, thus improving the patient's health and quality of life.**

After all, it is an easily identified,
preventable and treatable disease!

“ Recognising,
intercepting
and diagnosing
periodontal
disease at an
early stage.

CAUSES AND RISK FACTORS

State of health **Periodontal disease**



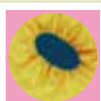
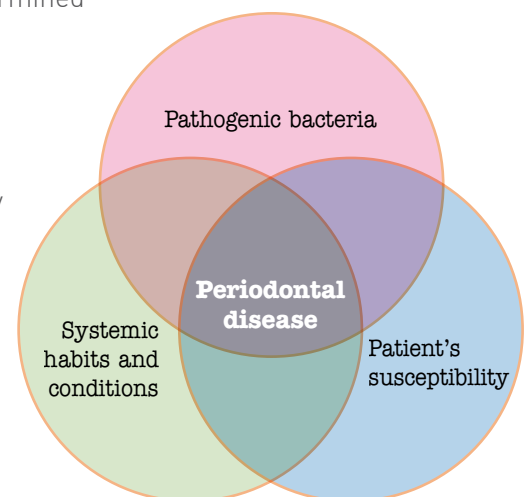
The main cause of this disease is an undisturbed accumulation of certain bacterial strains normally present in the oral cavity.

These bacteria are deposited daily in the gingival groove and, if they are not removed, their number increases and they aggregate, producing toxins causing inflammation of the gums. Periodontal disease can be broken down into two types, the first being gingivitis and the second periodontitis.

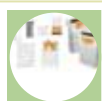
- **Gingivitis** affects the marginal gingiva and is characterised by reddening of the margin, oedema, bleeding on probing and, sometimes gingival hyperplasia. If sufficiently treated, gingivitis is entirely reversible, however if it is not sufficiently treated it can progress to periodontitis, which is an irreversible condition.
- **Periodontitis** is characterised by the gradual destruction of the tissue supporting the teeth. Clinically it shows as deepening of gingival pockets, with the loss of attachment and subsequent bone destruction, leading to mobility and potential loss of tooth.

- **The development of periodontal disease is due to co-factors** determined by individual susceptibility on a genetic basis and on lifestyles that enable the bacteria to express their pathogenic potential.

- **Poor or inadequate oral hygiene**
- **Smoking.** The cytotoxic substances contained in cigarettes destroy the cells whose job it is to maintain the tissues that support the teeth. That is why smokers have a faster and more aggressive progression of periodontitis.
- **Stress.** Stress weakens the immune defences and enables bacteria to spread.
- **Pregnancy** and significant hormone changes. Strong hormone fluctuations facilitate the onset of gingivitis.
- **Pharmacological treatment.** Contraceptives, antidepressants, anti-hypertensive drugs and others can cause an increase in volume of the gums and therefore have a negative impact on oral health.



Pathogenic
Bacteria



Smoking,
stress,
drugs



Cardiovascular
disease,
diabetes



Hereditary factors,
genetic heritage

■ **The general health condition of a patient also presents a risk factor for the development of periodontal disease.**

It can therefore be inferred that periodontitis is a disease with a high social impact, characterised by an infection that causes a chronic inflammatory response.

Some of the diseases and systemic disorders known to be risk factors are: diabetes, cardiovascular disease and, generally speaking, genetic and haematological diseases.

■ **Periodontal disease itself is a risk factor.** The local inflammation of the gum and periodontium caused by periodontitis has an effect on the patient's general health. Patients with periodontitis are subject to an increased risk of getting cardiovascular diseases, atherosclerosis and high blood cholesterol. Furthermore, the disease is correlated with obstetric complications in pregnancy and therefore with an increased risk of premature delivery or birth of an underweight baby.

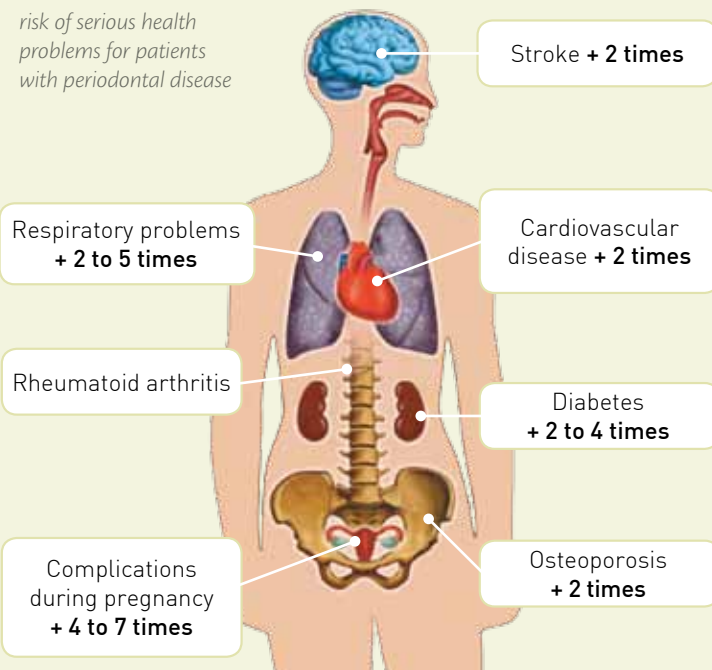
■ The relationship between periodontitis and systemic diseases has been extensively documented scientifically.

■ **It is therefore essential to improve oral health through prevention and the treatment of periodontal disease through an overall approach to the patient, analyzing and changing lifestyles affecting oral as well as systemic health.**

“ Preventing and treating periodontal disease through a global approach to patients.

DANGEROUS CO-RELATIONS

Potential increase in the risk of serious health problems for patients with periodontal disease

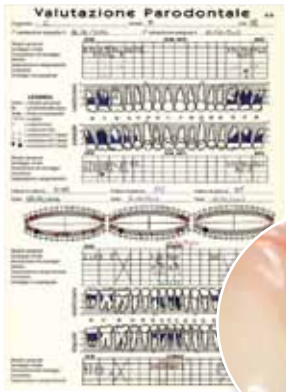


DIAGNOSIS AND SOLUTION

■ It is a very common mistake to underestimate these diseases and their warning signs, such as:

- **Reddening and swelling** of the gums
- **Bleeding** of the gums when brushing
- Persistent **bad breath (halitosis)**
- Presence of **gingival abscesses**
- **Hypersensitivity** to sudden temperature changes
- Tendency to **grind one's teeth (bruxism)**

Periodontal disease must be diagnosed rapidly by an in-depth clinical examination of the oral cavity and subsequent X-rays.



■ Periodontal disease must be diagnosed rapidly by an in-depth clinical examination of the oral cavity and subsequent X-rays.

Periodontal probing, combined with periodontal records, is an essential procedure since it enables the clinician to make a differential diagnosis, distinguishing between gingivitis and periodontitis, to BOP (Bleeding on Probing) and the depth of the pocket, in addition to estimating CAL (Clinical Attachment Level).

Probing is carried out with a periodontal probe, a gauged instrument that is inserted between the tooth and the gum at the correct angle. If the gum is healthy or simply affected by gingivitis, the probe will slide without descending below the gingival margin any deeper than 3 mm. If it goes deeper it means that the attachment fibres of the tooth have been destroyed.

Very often, periodontal treatment is limited to a session of oral hygiene.
This alone is not enough!

- Periodontal disease is chronic and as such it cannot be cured, however it can and must be treated. The sooner proper treatment is initiated, the success rate is achieved.
- Generally speaking, the successful treatment of periodontal disease depends on how serious it is. A fundamental rule is to make the patient aware of the need for thorough daily oral hygiene and regular check-ups (patient compliance).
- The first stage of the treatment consists of eliminating tartar and bacterial plaque, as the main cause of the infection, through scaling and root planing and debridement. The number of sessions required will depend on the extent and seriousness of the disease. If the condition does not improve considerably, it may be necessary to proceed to regenerative or resective surgery.
- In recent years, systemic antibiotic therapy has become widespread as an additional therapeutic tool. This solution, however, does not always guarantee effective and lasting results, considering the side effects and the risk of increased bacterial resistance. It should be considered that 70% of predisposed patients develop resistance to antibiotic therapy with Amoxicillin, contributing to failure of the treatment.

There is now an innovation in dentistry for treating periodontal disease: FotoSan® 630!

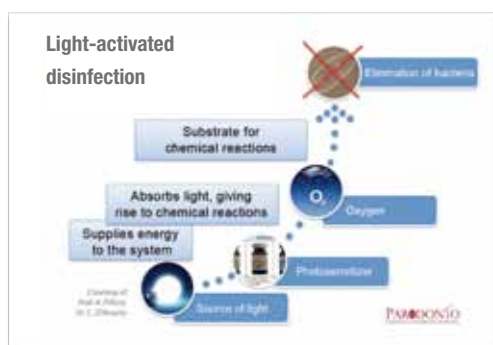
- It is a LED light based on the principle of photodynamic therapy (Light Activated Disinfection or Photo Activated Disinfection), the ideal solution for fast and easy disinfection of the tissues.

“ Periodontal disease cannot be cured, however it can be kept under control.”



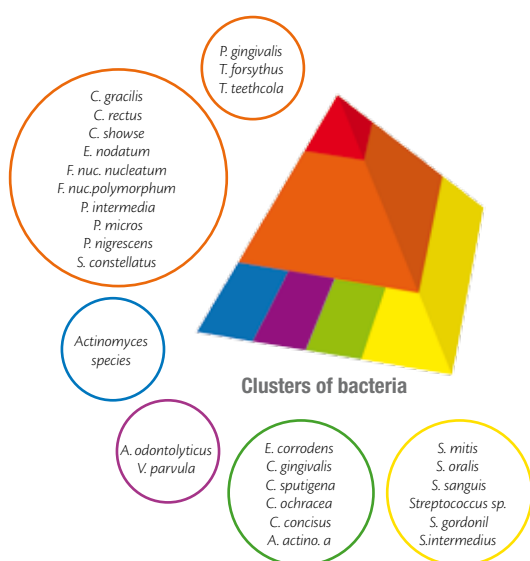
LIGHT ACTIVATED DISINFECTION OR LAD

- For several years now, many fields of medicine have been exploiting the potential of photodynamic therapy. This treatment is valued and widely used in particular in oncology treating dermatological tumours.
- In recent years LAD treatment has been met with increased interest because it is efficient, fast and easy to apply. Furthermore, the increased resistance of bacteria to antibiotic therapy has led to the need for new non-invasive therapeutic solutions.
- **The invention of LED (Light-emitting Diode) lights such as FotoSan® 630** has facilitated the use of LAD also in dentistry, and has immediately proven to be particularly effective treating localised infections of the oral cavity.
- Its success in dentistry has been demonstrated by many in vitro and in vivo studies in the fields of endodontics, periodontics and implantology



LAD (Light Activated Disinfection) is a form of medical treatment involving three essential components: light, a light-sensitive substance (photosensitizer) and oxygen.

- Light activated disinfection is based on the use of a photosensitizer, for example toluidine blue O (TBO), which binds to the bacterial membranes and is activated by a light source (LED light) of a specific wavelength (630 nm approx.). Light at this wavelength has excellent conduction through human tissues. The energy from the light emission is absorbed by the photosensitizer then released again to react with oxygen producing free radicals and ions (super oxides and peroxides). In total they are called Reactive Oxygen Specimens (ROS). ROS are extremely reactive immediately destroying the microbial membranes. Even more importantly the ROS also destroy the biofilm ensuring a longer lasting effect.
- Compared with the conventional treatments used in dentistry to treat periodontal disease, **LAD photodynamic therapy with FotoSan® 630 is the ideal solution for efficient, fast and simple disinfection**, since it is equally effective against bacteria that are resistant and/or susceptible to antibiotics.
- The treatment can be repeated without any side effects, and any risks of causing resistant strains.



- FotoSan® 630 therapeutic treatment is effective against bacteria, fungi, viruses and protozoa, and is able to destroy 99% of the bacteria present in the biofilm. Furthermore, repeating of the light-sensitive action does not cause bacterial resistance.

Do you know of
any other treatment
giving similar
results?



	Surgical laser	LAD therapy with FotoSan® 630	Pharmacological antibiotherapy (local or systemic)	Pharmacological antimicrobial therapy (mouthwashes with chlorhexidine)
Principle	Heat	Photochemical reaction	Pharmacological	Chemical
Strong points	<ul style="list-style-type: none"> • Immediate effect • Elimination of bleeding of the gums • No risk of bacterial resistance 	<ul style="list-style-type: none"> • Simplicity of treatment • Immediate effect • Elimination of bleeding of the gums • No risk of bacterial resistance • Effective against all microorganisms • The treatment can be repeated several times • Limited cost 	<ul style="list-style-type: none"> • Simplicity of treatment 	<ul style="list-style-type: none"> • Simplicity of treatment • Reduction of bacterial plaque • Anti-inflammatory action • No risk of bacterial resistance
Limits	<ul style="list-style-type: none"> • Risk of tissue damage (the laser does not distinguish the bacteria from the cells) • The treatment can be repeated with caution • Safety precautions • High cost 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • Uncertain clinical effect • Low release of ppm in situ • Allergic reactions and/or malaise • Gastro-intestinal discomfort 	<ul style="list-style-type: none"> • Unpleasant taste • Does not reach gingival pockets • The bacterial biofilm is not destroyed.
Side effects	<ul style="list-style-type: none"> • Risk of heat damage 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • Risk of bacterial resistance 	<ul style="list-style-type: none"> • Risk of discolouring of teeth and mucous membrane if used for too long

Advantages for the patient

Painless treatment
No need for anaesthesia
No side effects
Less invasive preparation
Results visible after only a few applications

Advantages for the dentist

Simple supporting treatment for normal reconstruction procedure
Rapid treatment in a single session
Safe treatment at a very low cost and with great flexibility
No safety precautions required
Greater comfort and satisfaction

“ 99% of the bacteria are destroyed! Immediate bactericidal effect with no side effects.”



LAD APPLICATIONS

■ Gingivitis and pericoronitis

Gingivitis may be treated with conventional methods (removal of tartar) and antimicrobial aids such as gels and mouthwashes containing chlorhexidine.

In the acute stage, antibiotic and anti-inflammatory treatments are generally used.

LAD is an advanced therapeutic aid that, being a non-invasive treatment, is more comfortable for the patient and provides better end results.

■ Periodontal treatment

Conventional methods removing plaque and tartar from the tooth surface: scaling and root planing, debridement are the basis of any periodontal treatment. However this mechanical cleaning may now be upgraded by antimicrobial photodynamic therapy that, thanks to its powerful disinfection effect, destroys the bacteria that are the source of infection. The mechanical disruption of the biofilm combined with the biochemical destruction of the biofilm by the LAD treatment go well together in creating a longer lasting antibacterial effect.

LAD eliminates further perio-pathogen bacteria, resulting clinically in a reduction of pocket depths and a lower bleeding index (BOP).

■ Endodontic treatment

One of the important steps in endodontic treatment consists of disinfection of the instrumented root canal. Traditionally destruction of the bacteria is achieved by rinsing with EDTA/ sodium hypochlorite/citric acid/chlorhexidine, although their ability to penetrate is limited and subject to effective instrumenting of the endodontic space.

LAD as an adjunctive therapy to rinsing will kill a significantly higher number of the bacterial load, securing a statistically better clinical success rate.

■ Peri-implantitis

World-wide 12-15 million implants are placed every year.

Peri-implantitis is a disease that can have a negative impact on the outcome of implantological therapy. Once the peri-implant tissues are exposed to the oral cavity, they offer an ideal environment for colonisation and proliferation of bacteria, beginning as mucositis (already visible just after removal of the healing screw).

Peri-implantitis progresses much faster than periodontitis. Furthermore, patients with serious or acute periodontitis can experience serious complications in the positioning of implants. The treatments for dealing with peri-implantitis can be pharmacological, although the potential side effects must be considered.

LAD guarantees a significant reduction of bacteria without any invasive effects. Furthermore, it enables a high level of disinfection of the oral cavity, preventing attacks by bacteria and thus eliminating the direct cause of the infection, stopping progress of the disease and improving the prognosis for the tooth involved.

■ Treatment of caries

LAD is also particularly suitable for decontaminating a cavity affected by deep and destructive carious processes. It is thus possible to eliminate all the bacteria to an extent the use of rotating instruments alone does not guarantee.

Furthermore, since this treatment is minimally invasive, it facilitates high-quality aesthetic reconstruction.

The success of FotoSan® 630 treatment is documented by:

- numerous clinical cases ■ statements by users
- abstracts from scientific studies (in vivo and in vitro).

Clinical case 1 Treatment of periodontitis

Dr. Marisa Roncati Parma Benfenati, Italy

External faculty member at the Polytechnic University of the Marche Region – Responsible for the teaching module “Follow up and professional post-prosthetic hygiene” for the level II masters’ degree in “Prostheses and implant prostheses using advanced technology” at Bologna University.

LAD treatment using the FotoSan® 630 with the long perio tip at the bifurcation (3rd degree). The purpose is to achieve a bactericidal effect and thereby stimulate the healing of the periodontal tissues.

The patient has locally a serious aggressive form of frontal periodontal disease, associated with bleeding on probing. In spite of very careful hygiene, aggressive and virulent forms of bacteria were present. It was difficult to completely eliminate these from such deep pockets using only conventional methods.

The application of LAD was an additional “strategy”, with the aim of extending the survival of a tooth with such a badly damaged periodontium.



Figure 1: Probing the damaged tooth (8 mm)



Figure 2: Application of toluidine blue (TBO)



Figure 3: Inserting the perio tip into the pocket



Figure 4: Activation of the FotoSan® 630 light



Figure 5: Activation of the FotoSan® 630 light

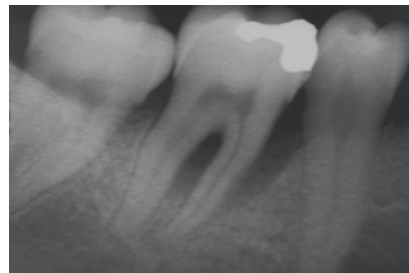


Figure 6: Follow-up X-ray

Clinical case 2 Endodontic treatment

Dr. Cristiano Boggian – Dr. Lavinia Solidoro, Italy

Private practice in Milan



Figure 1:
Initial X-ray



Figure 2:
Working length test



Figure 3: Instrumenting with Revo-S Micro-Méga



Figure 4: Rinsing with hypochlorite and endocanal suction



Figure 5: Drying the canal



Figure 6: Choosing the FotoSan agent in a syringe (low viscosity)



Figure 7: Applying the FotoSan agent



Figure 8: Inserting the endo tip into the cavity



Figure 9: Activation of the FotoSan® 630 light for 30"



Figure 10: Rinsing and drying before filling

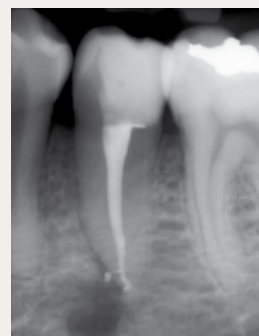


Figure 11:
Closure. Radio-transparency highlights the mental foramen of the mandibular nerve

Clinical case 3 Treatment of peri-implantitis

Dr. Nicola De Angelis, Italy

External faculty member at Genoa University, private practice in Acqui Terme (province of Alessandria)

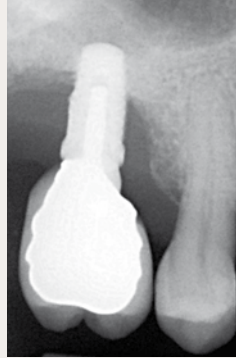


Figure 1: Initial X-ray



Figure 2: Deep probe at the height of the implant in position 16. Considerable bleeding indicating serious inflammation



Figure 3: Application of toluidine blue (TBO) and fitting of the perio tip onto the FotoSan® 630 light. The procedure does not cause any bleeding and does not require anaesthesia



Figure 4: The FotoSan® 630 emits light in the red spectrum at 630 nm and enables activation of the toluidine blue, which acts as a powerful antibacterial agent



Figure 5: One month after the treatment the inflammation has disappeared



Figure 6: Follow-up X-ray one month after treatment

Clinical case 4 Treatment of periodontitis

Professor Andrea Pilloni – Dr. Claudio Mongardini, Italy

La Sapienza University, Rome – Department of Periodontology



Figure 1: Periodontal abscess of tooth 45 in a male patient, a smoker with refractory generalised chronic periodontitis



Figure 2: Probing revealed the presence of purulent exudate, a 9 mm pocket and a loss of attachment of 11 mm

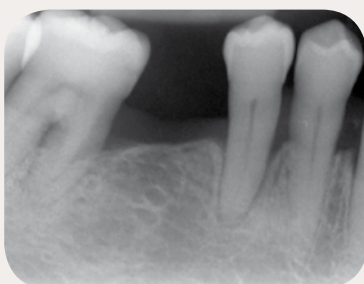


Figure 3: The diagnosis is confirmed also by an intraoral X-ray



Figure 4: After mechanical instrumentation of the abscess, the site was filled with toluidine blue (TBO), which was then activated using the FotoSan® 630 LED light. No systemic antibiotics were administered



Figure 5: One week after the treatment it can be seen that the symptoms and the bleeding on probing have disappeared; in addition the pocket has been reduced and periodontal attachment has recovered by over 3 mm



Figure 6: The follow-up at 3 months confirmed that tooth 45 had remained healthy. The depth of the probe had further decreased to 2.5 mm and the gain in clinical attachment was found to be of 6 mm compared with the initial situation



Figure 7: Follow-up X-ray one year later, confirming good clinical healing

Clinical case 5 Treatment of peri-implantitis

Dr. Antonia Abbinante – Dr. Anna Rita Clemente –
Dr. Alessandro Nisio, Italy

Centro Odontoiatrico Specialistico Nisio - Bari

Case of peri-implantitis of tooth 36 characterised by swelling and reddishness of the tissues in a female patient, a non-smoker in good general condition.

The initial probe revealed a 5-mm peri-implant pocket. All the sites probed – mesial, vestibular, palatal – bled, the X-ray revealed a mesial loss of bone of 3 mm and a distal loss of 3.2 mm and 75% of the implant surface was covered with plaque.

After debridement of the surface of the implant, with US instrumentation and Teflon curettes, disinfection treatment with photodynamic therapy was carried out. The subsequent follow-up examinations and retreatments, carried out 1 week, and 1, 4 and 12 months later, revealed progressive reduction of the indexes of gingival inflammation (0% plaque and 0% bleeding). The peri-implant pocket had returned to within the physiological limit of 3 mm, the implant was stable and the decongested tissue had adhered to the surface of the implant.



Figure 1: Initial X-ray



Figure 2: Initial situation



Figure 3: Follow-up 1 week after the treatment with FotoSan® 630



Figure 4: Follow-up 1 month after the treatment



Figure 5: Follow-up 4 months after the treatment



Figure 6: Follow-up 1 year after the treatment

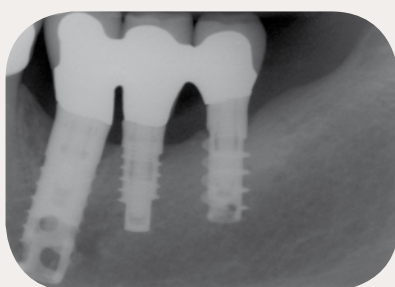


Figure 7:
Final X-ray

Clinical case 6 Dry socket

Dr. Caroline N. Franco, private practice

Manila, The Philippines

The patient is a 20 year old female, who had previous tooth extraction 5 days prior to consultation. Main complaint is vague pain on extraction site and foul breath odour. She was on pain medication since it started.

TREATMENT: Curettage & Debridement of Extraction Site with FotoSan



Figure 1: Extraction site with dry socket



Figure 2: FotoSan agent application after debridement



Figure 3: FotoSan illumination 2 x 10 seconds



Figure 4: Post-op: 4 days after, site showing signs of healing, absence of pain.

Clinical case 8 Periodontitis

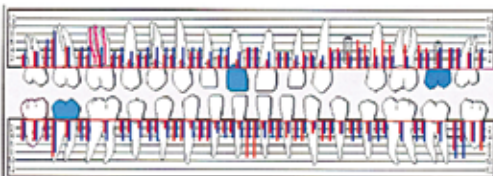
Dr. Susanne Dalsgaard, private practice

Copenhagen, Denmark

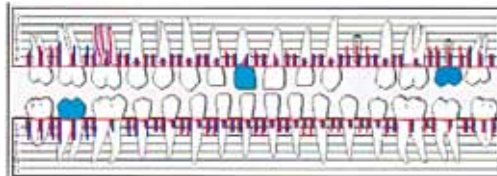
Male generally healthy patient at age 48. The patient comes because of a lost crown on implant. A routine check up reveals several pathological pockets with signs of inflammation. Pocket depths were found to be 5-6 mm in molar regions and up to 9 mm in lower front.

Pocket registration on February 14th 2011, at first visit. SRP with hand instruments and ultrasound. All pockets with signs of inflammation and/or deeper than 4 mm were further treated with FotoSan 4 x 10 s each.

Pocket registration from 14-02-2011



Pocket registration from 08-03-2011



Clinical case 7 Soft tissue trauma secondary to surgery

Dr. Caroline N. Franco, private practice

Manila, The Philippines

The patient is 24 years old, female, who underwent difficult impacted third molar surgery. Due to limited mouth opening and difficult position of the impacted tooth, soft tissues of the cheek was traumatized by the high speed handpiece.

TREATMENT: Fotosan treatment of the traumatized soft tissues and suture sites to prevent ulceration and promote faster wound healing



Figure 1: Traumatized cheek tissues



Figure 2: Fotosan agent application on soft tissue injuries and suture site after surgery



Figure 3: Fotosan illumination 10 seconds per site

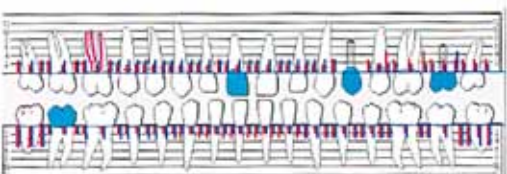


Figure 4: Post-op: 6 days after no trace of soft tissue traumatic injury & suture sites healing uneventful, patient with minimal cheek swelling

Three weeks later, on March 8th, 2011, inflammatory signs are almost gone, and deeper pockets are reduced in depth from 9mm to 4 mm.

4 weeks later, on April 4th, when the patient shows up for a new crown placement for the implant, all pockets are normalised except around semi-impacted 3rd molars that need to be extracted for proper infection control.

Pocket registration from 04-04-2011

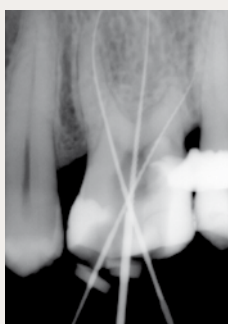




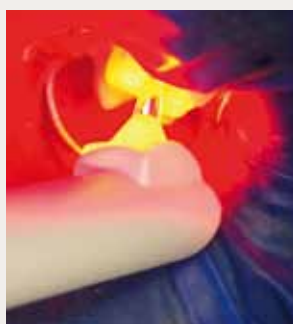
Dr. Cristiano Boggian - Private practice in Milan, Italy

For about the last 10 months I have been able to appreciate the effectiveness of photodynamic therapy (LAD) thanks to the use of the FotoSan® 630 light and the different viscosities of the TBO (toluidine blue) reagent, which enables it to be put into place in the best possible way, and it remains in situ very well. This means effectiveness in its various different fields of application.

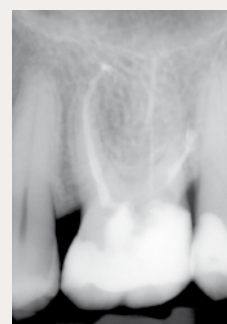
In addition to cases of periodontitis or in patients with peri-coronitis, in which I have observed the reduction of phlogistic and oedematous conditions and the subsequent absence of Bleeding on Probing , (BOP), I also use FotoSan® 630 in endodontics, combining LAD therapy with alternate rinses with NaOCl and EDTA. In this way, as confirmed in literature (cf. Abstract Rios et al. 2011), disinfection of the root canals can be achieved with a bacterial survival rate of 0.1%, thus reducing the risk of discomfort for the patients and ensuring long-term success of the endodontic treatment.



Testing the working length



Treatment with FotoSan® 630



Closure



Dr. Nicola De Angelis - External faculty member at the University of Genoa, private practice in Acqui Terme, Italy

I gave it a try, using photodynamic therapy systematically after the introduction of the FotoSan® 630 LED light, which has given rise to significant advantages (also by comparison with a laser source). It is a valid aid to be added to conventional periodontal treatments. In addition to cases with periodontal pockets featuring ample loss of support, in which I have observed recovery of stability and a significant reduction in BOP after only a few sessions with FotoSan® 630. For over a year now I have been conducting a randomised multi-centre study on the treatment of peri-implantitis.

The preliminary results appear to be really encouraging with regard to stopping the acute phase of the disease.



Initial condition



Condition 1 month after the treatment with FotoSan® 630



Professor Andrea Pilloni

Dr. Claudio Mongardini

La Sapienza University, Rome, Italy – Department of Periodontology

Dentists and periodontologists are faced with a formidable challenge. Although scaling and root planing are the standard treatment for periodontitis, it is not always possible to eliminate plaque and tar-tar completely.

The in-depth knowledge of photodynamic therapy in other branches of medicine and the invention of a tool that can be afforded by anyone, that is to say the FotoSan® 630 LED light, have enabled us to continue exploring what has been well known for a great many years, that is to say that the presence of pathogenic bacterial flora in the gingival margins in susceptible patients causes periodontitis to start. The use of systemic antibiotics, which are often prescribed, can lead in some cases to the development of forms of resistance to antibiotics.

Thanks to the combined use of a source of light in a specific wavelength spectrum and of a light-sensitive agent, we have investigated many case histories and developed a series of in vitro and in vivo studies.

These bear witness to the fact that this LAD therapy constitutes a significant improvement, from both the clinical and the microbiological points of view, in terms of the reduction of flora pathogenic for the periodontium present in the dental biofilm, to a degree that the use of non-surgical mechanical periodontal therapies is unable to achieve.

The ease of use of FotoSan® 630, the rapidity of treatment and the safe methodology make it an aid able to optimise cost-effectiveness.



Initial condition



Condition 3 months after the treatment with FotoSan® 630



Dr. Antonia Abbinante

Dr. Alessandro Nisio

Centro Odontoiatrico Specialistico Nisio - Bari, Italy

On its own, breaking up the biofilm, which is carried out by means of conventional scaling and root planing in non-surgical causal therapy does not guarantee disinfection from bacteria that are pathogenic for the periodontium.

Starting almost two years ago, therefore, we have associated photodynamic therapy with the conventional treatments for periodontitis and peri-implan-titis, and have obtained excellent results. In many patients who had peri-implant inflammation due to bacterial biofilm and hyperplasia with an

advanced oedematous condition, even in the presence of exposure of the spirals of the implants, we have observed a considerable reduction of the oedema, with consequent decongestion of the tissues.

The ideal indication that enables the effectiveness of FotoSan® 630 to be appreciated in the various clinical profiles of the patients is precisely the presence of hyperplasia and oedema. The simplicity of the procedures, the time saved and the perception of the results enables us to obtain a more immediate and lasting compliance on the part of our patients.



Initial condition



Condition 1 year after the treatment with FotoSan® 630



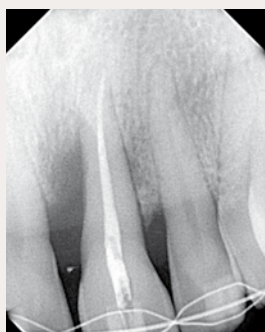
Dr. Riccardo Perissinotto - private practice in San Donà di Piave, Italy

For some time I had been looking for an effective way of treating peri-implantitis, that is still one of the most difficult complications to manage in the field of implants, even today. Thanks to its photodynamic therapy, FotoSan® 630 turned out immediately to be a powerful ally in many clinical situations, since it enables the quantity of bacteria to be reduced considerably without having to resort to the administration of local or systemic antibiotics. This treatment guarantees regression of the disease, and the patient can note immediate benefits already after only a few sessions.

In the case shown in the X-ray, the patient was a 50 year-old smoker who complained of pain in zone 2.1. The probe had highlighted a defect of 15 mm. The treatment plan called for devitalisation, orthodontic treatment and GBR. Three days after the first treatment the patient already reported an improvement. After three cycles of FotoSan® 630 at intervals of 15 days, a recovery of about 6 mm was appreciated in 5 months.



Mobility of the teeth



1 week after the treatment with FotoSan® 630



Removal of the granulation tissue after detachment of the flap. The depth of the pocket can be seen.



Recovery of attachment 5 months after treatment with FotoSan® 630

Dr. Antonio Del Ben - Private practice in Trieste, Italy

I have been using photodynamic therapy with the FotoSan® 630 LED light for one and a half years now, and from the very beginning I noted excellent benefits for the tissues in the treatment of periodontal pockets featuring a loss of attachment and bleeding or oedematous states. After only one week from the first treatment sessions, the patients themselves told me that the discomfort defined by them as "red and swollen gums" and "blood on my toothbrush" had decreased. This induced me to combine therapy with FotoSan® 630 also in the initial stages of peri-implantitis observed by me in my surgery. I must say that I find it a good aid precisely for fighting progress of the disease.

Dr. Alessandro Pergola - Private practice in Rome, Italy

Nowadays it has been established with certainty that a clearly defined group of bacteria that multiply in the depths of gingival pockets are the main cause of periodontal disease in youth, which becomes progressive in adults. There is therefore a need for a specific diagnosis and treatment.

The use of FotoSan® 630 has enabled me to tackle this disease in the best possible manner, using minimally invasive procedures but with effective results and an immediate sensation of wellbeing for my patients.



Dr. Caroline N. Franco - Private practice, Manila, The Philippines

FotoSan has revolutionized the way we treat dental infections in our office. From simple disinfection of deep carious lesions to disinfection of root canals, FotoSan has given us better results.

Even our patients were satisfied with FotoSan because it gave them immediate relief from painful apthous ulcers and even candidiasis.

When patients ask about FotoSan, they always want to try it because the treatment is simple, works fast, and very safe. Best of all, the application of FotoSan is painless and not intimidating!

26 years old patient, with a main complaint of pain, buccal swelling on tooth no. 22 (upper left lateral incisor). Due to patient's time constraint, a one-sitting endodontic therapy with apicoectomy was done.

Treatment: Routine endodontic therapy on tooth no. 22 with rotary files, disinfected with sodium hypochlorite and FotoSan, and obturated with One-Step Obturator. Immediate statement apicoectomy was done to remove granulation tissue and granuloma at the periapical area. FotoSan was applied before flap closure and after suturing.



1. Pre-operative radiographs



2. Granuloma & granulation tissues exposed after flap incision



3. After curettage and retrograde filling



4. FotoSan agent application prior to flap closure



5. FotoSan light illumination 10 sec.



6. FotoSan agent application on suture sites



7. FotoSan light illumination 10 seconds each on vertical incision & interdental sites



8. Post-operative radiograph after 7 days: patient is asymptomatic, soft tissue healing uneventful



Dr. Chung Kong Mun - Dental Surgeon & Periodontist

BDS (S'pore), MS (Temple U., USA), Cert. in periodontics (Temple U, USA), FAM (Periodontics) S'pore

Case report on use of LAD (FotoSan) for non-surgical disinfection of pockets during periodontal maintenance.

42yr female patient on 6 months maintenance recall, visits 5 years after completion of periodontal and implant treatment. This patient displayed good oral hygiene habits and all sites probing <4mm.

During a recent maintenance three sites were identified with 5mm probing and bleeding upon probing at the mesio-palatal of #16; disto-palatal of #27 and mesio-palatal of #28. Following routine scaling, these three sites were further treated with LAD using FotoSan high viscosity gel and exposure time of 20 sec per pocket site.

At 1-month review visit after LAD therapy, all treated sites demonstrated improved clinical signs with no bleeding upon probing and probing of <4mm.

In my opinion, LAD offers the clinician the ability to perform disinfection of pocket sites which potentially contributes towards improved clinical signs.



Dental hygienist Jeanne Bindeslev - private practice Espergaerde, Denmark

I have used FotoSan since Fall 2009 as a routine supplement treatment of acute and chronic marginal periodontitis. I am used to seeing good clinical response on the FotoSan treatment, however lately I experienced a true "sunshine" case:

One of my regular periodontitis patients had undergone radiation and chemo therapy for throat cancer and developed a severe oral candidiasis, with symptoms of disturbed taste, burning sensation of tongue and mucosa and pain when swallowing. She had suffered a substantial weight loss since eating was severely compromised. As part of the hospital treatment all available medications had been tried without effect on the candidiasis.

Treatment: FotoSan Agent HIGH viscosity of mucosa and FotoSan illumination.

I knew from the first study from Aarhus University with FotoSan that C. Albicans can be killed successfully with LAD so I decided to give it a try. I applied FotoSan agent HIGH first on right buccal mucosa and used the FotoSan light in the 10 sec continuous mode programme on the surface. I repeated for the left side and finally the tongue. In total a treatment of less than 3 minutes illumination.

The patient called 4 days later and said that already the next day the symptoms were gone. Now 2 months later there are still no signs of the candidiasis following that single FotoSan treatment.

Poggio C, Arciola C R, Dagna A, Florindi F, Chiesa M, Saino E, Imbriani M, Visai L.

PHOTOACTIVATED DISINFECTION (PAD) IN ENDODONTICS: AN IN VITRO MICROBIOLOGICAL EVALUATION.

International Journal of Artificial Organs 2011.

ABSTRACT

Objective: The objective of the present study was the in vitro evaluation by TT test of the antimicrobial effect of photo activated disinfection (PAD) and, comparatively, of a conventional 5,25% NaOCl irrigating solution.

Methods: Enterococcus faecalis, Streptococcus mutans and Streptococcus sanguis strains were selected for the test. Freshly extracted single-rooted human teeth were endodontically treated, inoculated with bacterial strains and then divided into different groups, each of them treated with PAD, with PAD plus 0.5% NaOCl solution, with TBO, with PAD for longer time and with 5% NaOCl solution (positive control).

Results: The results were significantly different among the various groups, and for Enterococcus faecalis, Streptococcus mutans and Streptococcus sanguis. PAD applied for a longer time (in respect to manufacturer's instructions) or PAD associated to 5% NaOCl showed the significantly higher antibacterial effects.

Schlafer S., Vaeth M., Hørsted-Bindslev P., Frandsen E. V. G.

ENDODONTIC PHOTOACTIVATED DISINFECTION USING A CONVENTIONAL LIGHT SOURCE: AN IN VITRO AND EX VIVO

STUDY.

Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010; 109:634-641

ABSTRACT

Objective: The antimicrobial effect of photoactivated disinfection (PAD) using toluidine blue and an LED lamp was tested on endodontic pathogens in planktonic suspension and after inoculation into extracted teeth. Irradiation time was limited to 30 seconds.

Methods: The effect of PAD on planktonic suspensions of Escherichia coli, Candida albicans, Enterococcus faecalis, Fusobacterium nucleatum, and Streptococcus intermedius was analyzed using Poisson regression. Moreover, cultures of S. intermedius were inoculated into prepared root canals of extracted molars. The effect of PAD performed immediately after inoculation or after overnight bacterial incubation was determined by a 2-sample t test.

Results: Photoactivated disinfection yielded significant reductions ($P < .001$) in the viable counts of all organisms in planktonic suspension. The PAD treatment of S. intermedius in root canals yielded a mean log₁₀ reduction of 2.60 ($P < .001$) immediately after inoculation and of 1.38 ($P < .001$) after overnight incubation.

Conclusions: Photoactivated disinfection using a conventional light source strongly reduces the number of viable endodontic pathogens in planktonic suspension and in root canals.

Rios A DDS, He J. DMD, PhD, Glickman G., DDS, MS, MBA, JD, Spears R., PhD, Schneiderman E. D., PhD, Honeyman A. L., PhD.

EVALUATION OF PHOTODYNAMIC THERAPY USING A LIGHT-EMITTING DIODE LAMP AGAINST ENTEROCOCCUS FAECALIS IN EXTRACTED HUMAN TEETH.

Journal of Endodontics 2011, Volume 37, No. 6

ABSTRACT

Objective: Photodynamic therapy (PDT) with high-power lasers as the light source has been proven to be effective in disinfecting root canals. The aim of this study was to evaluate the antimicrobial effect of PDT using toluidine blue O (TBO) and a low-energy light emitting diode (LED) lamp after the conventional disinfection protocol of 6% NaOCl.

Methods: Single-rooted extracted teeth were cleaned, shaped, and sealed at the apex before incubation with Enterococcus faecalis for 2 weeks. Roots were randomly assigned to five experimental groups and three control groups. Dentin shavings were collected from the root canals of all groups with a #50/.06 rotary file, colony-forming units were determined, and the bacterial survival rate was calculated for each treatment.

Results: The bacterial survival rate of the NaOCl/TBO/light group (0.1%) was significantly lower ($P < .005$) than the NaOCl (0.66%) and TBO/light groups (2.9%).

Conclusions: PDT using TBO and a LED lamp has the potential to be used as an adjunctive antimicrobial procedure in conventional endodontic therapy.

Ng R., DDS, Singh F., DDS, Papamanou D. A., DDS, Song X., MD, MS, Patel C. BS, Holewa C., BS, Patel N., BS, MS, Klepac-Ceraj V., PhD, Fontana C. R., DDS, PhD, Kent R., ScD, Pagonis T. C., DDS, MS, Stashenko P. P., DMD, PhD, Soukos N. S., DDS, PhD.

ENDODONTIC PHOTODYNAMIC THERAPY EX VIVO.

Journal of Endodontics 2011.

ABSTRACT

Objective: The objective of this study was to evaluate the antimicrobial effects of photodynamic therapy (PDT) on infected human teeth ex vivo.

Methods: Fifty-two freshly extracted teeth with pulpal necrosis and associated periradicular radiolucencies were obtained from 34 subjects. Twenty-six teeth with 49 canals received chemomechanical debridement (CMD) with 6% NaOCl, and 26 teeth with 52 canals received CMD plus PDT. For PDT, root canal systems were incubated with methylene blue (MB) at concentration of 50 µg/ml for 5 minutes, followed by exposure to red light at 665 nm with an energy fluence of 30 J/cm². The contents of root canals were sampled by flushing the canals at baseline and after CMD alone or CMD+PDT and were serially diluted and cultured on blood agar. Survival fractions were calculated by counting colony-forming units (CFUs). Partial characterization of root canal species at baseline and after CMD alone or CMD+PDT was performed by using DNA probes to a panel of 39 endodontic species in the checkerboard assay.

Results: The Mantel-Haenszel x² test for treatment effects demonstrated the better performance of CMD+PDT over CMD (P = .026). CMD+PDT significantly reduced the frequency of positive canals relative to CMD alone (P = .0003). After CMD+PDT, 45 or 52 canals (86.5%) had no CFUs as com-

pared with 24 of 49 canals (49%) treated with CMD (canal flush samples). The CFU reductions were similar when teeth or canals were treated as independent entities. Post-treatment detection levels for all species were markedly lower for canals treated by CMD+PDT than they were for those treated by CMD alone. Bacterial species within dentinal tubules were detected in 17 of 22 (77.3%) and 15 of 29 (51.7%) canals in the CMD and CMD+PDT groups, respectively (P = .034).

Conclusion: Data indicate that PDT significantly reduces residual bacteria within the root canal system, and that PDT, if further enhanced by technical improvements, holds substantial promise as an adjunct to CMD.

Gambarini G, Plotino G, Grande MN, Nocca G, Lupi A, Giardina B, De Luca M, Testarelli L.

IN VITRO EVALUATION OF THE CYTOTOXICITY OF FOTO SAN™ LIGHTACTIVATED DISINFECTION ON HUMAN FIBROBLASTS.

Medical Science Monitor – International Medical Journal for Experimental and Clinical Research 2011.

ABSTRACT

Objective: Root canal disinfection needs to be improved because actual techniques are not able to eliminate all microorganisms present in the root canal system. The aim of the present study was to investigate the in vitro cytotoxicity of FotoSan (CMS Dental ApS, Copenhagen, Denmark), 17% EDTA and 2 % chlorhexidine.

Methods: Fibroblasts of periodontal ligament from healthy patients were cultured. FotoSan (with and without light activation for 30 sec.), 17% EDTA

and 2 % chlorhexidine were used for the cell viability tests. Untreated cells were used as control. The cellular vitality was evaluated by MTT test. The production of reactive oxygen species (ROS) was measured using an oxidation-sensitive fluorescent probe. Results were statistically analysed by ANOVA, followed by a multiple comparison of means by Student-Newman-Keuls, and the statistical significance was set at P < 0.05.

Results: MTT tests showed that cytotoxic effect of FotoSan (both photo-cured and uncured) were statistically lower (P < 0.05) than that observed using 2% Chlorhexidine, while no significant differences were found in comparison with 17% EDTA. No Alterations in ROS production were detectable in any of the tested materials.

Conclusions: Since the toxicity of the FotoSan photosensitizer, both light-activated and not light-activated, is similar to common endodontic irrigants, it can be clinically used with precautions of use similar to those usually recommended for the above-mentioned irrigating solutions.

FAQ FREQUENTLY ASKED QUESTIONS

Which bacteria are killed using LAD therapy?

■ LAD therapy has been tested on several types of microorganisms; based on this it can be concluded that it is effective on all bacteria, viruses, fungi and protozoa – at variable speed.

Is LAD therapy effective also in respect of anaerobic bacteria?

■ Yes. LAD therapy is effective on both aerobic and anaerobic bacteria. The anaerobic bacteria typically hide in a biofilm, but because of the scaling prior to the FotoSan treatment, the biofilm is disrupted. However more importantly the reactive oxygen species (ROS) destroys the polysaccharides in the biofilm, exposing the bacteria. Remember also that the FotoSan Agent you inject into the pocket contains oxygen.

Why are only the pathogen bacteria killed?

■ Well, it is not the case. All bacteria are killed – at variable speed. However the “good” bacteria will get a head start in recolonizing the pocket. It is a race between the good and bad bacteria, and the good will take over – after all they are more abundant. Comparing bacteriological results, there are less bad bacteria in week 12 than in week 6 – even after one single FotoSan treatment.

What is the difference between Toluidine Blue and Methylene Blue?

■ It is the same type of substance, with identical effects. The main difference is the maximum absorption of the light, which is 630 nm for Toluidine Blue and 660 nm for Methylene Blue and for this reason different light sources are required to activate the chemicals.

Why does LAD therapy not damage human cells but only pathogen bacteria?

■ Toluidine Blue does not bond to intact human cells. The reactive oxygen specimens (ROS) created in the process, have an extremely short life time (nano seconds). As the ROS are created close to the target i.e. the bacteria are destroyed immediately.

What about when the root canal is curved, does the light get all the way to apex?

■ Yes. The root canal has been filled with FotoSan Agent, so the canal itself will work as a light guide. To be sure to get enough light energy we recommend to give an extra 30 seconds if the tip does not go approximately 2/3 into the canal.

Is it possible to work on an open wound? What if there is bleeding?

■ Yes, it is. Several dentists have noted that the treatment has a haemostatic effect. This can be explained by the interaction between the Reactive Oxygen Species (ROS) and the blood proteins. Bleeding does however dilute the LAD effect somewhat.

What is the concentration of the Toluidine Blue (TBO) in the FotoSan Agent?

■ The FotoSan Agent is available with three different viscosities (Low, Medium and High), all with the same concentration of active ingredient Toluidine Blue (TBO) of 0,1 mg/ml.

What happens in cases of open apices, if the Toluidine Blue penetrates the tissue?

■ Nothing. Toxicological tests have shown that there are no side effects when using Toluidine Blue.

Is it possible to use FotoSan Agent together with another LED light or laser?

■ Theoretically, yes. It is, however, necessary to make sure that the emission spectrum peaks at around 630nm. Also, if the light is not as powerful as the FotoSan light you will have to compensate by using longer treatment time. Remember that it is the emitted energy, i.e. output power x time that is important. So half the output power means double treatment time.

When using FotoSan® 630 in root canal treatment, do you still need to disinfect with Sodium Hypochlorite?

■ Yes. The Sodium Hypochlorite is used in combination with the mechanical preparation of the root canal and the same is EDTA. However, it has been shown that adding the FotoSan® 630 treatment provides a significantly better bactericidal effect.



FotoSan® 630

- Pen-grip for optimal control
- Bilateral identical control buttons
- Manual, semi-automatic and automatic programs
- 5 different adjustable tips



TECHNICAL SPECIFICATIONS

Power supply

Input power: 100-240VAC, 50/60 Hz

Output power: 5.0VDC, 1.0A

Battery

Nominal voltage: 3.2V

Nominal capacity: 1.200mA

Battery type: LiFePO4

Re-charging time: 2 hours

User capacity: Approx. 760 seconds


LED diode


Output intensity: 2.000 – 4.000 mW/cm²

Wavelength: 620-640nm (85%), peak 630 nm




PACKAGING

	FOTOSAN® 630 KIT The kit contains: 1 light, 1 docking station, 50 single-use tips (10 each type: endo, perio long, perio short, blunt 4mm, blunt 8mm), 20 single-use covers, 1 box of FotoSan Agent in syringes (1 Low, 2 Medium, 2 High viscosity), 1 eye protection.
---	---

	FOTOSAN® 630 FOTOSAN AGENT IN VIALS Box of 6 pieces each 6 ml
---	---

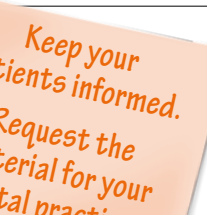
	FOTOSAN® 630 FOTOSAN AGENT IN SYRINGES Box of 5 pieces each 1,2 ml
---	--

	FOTOSAN® 630 SINGLE-USE APPLICATION TIPS Box of 100 pieces A variety of application tips
--	---

	FOTOSAN® 630 SINGLE-USE TIPS FOR THE LIGHT Box of 50 pieces A variety of tips
---	--

	FOTOSAN® 630 SINGLE-USE COVERS Bag of 10 pieces
---	---

	FOTOSAN® 630 GLASSES Protection glasses 1 pair
	Protection glasses Flip-Up 1 pair

	FOTOSAN® 630 PATIENT INFORMATION 50 patient folders
---	---

PRODUCT	ITEM NO.
FotoSan® 630 Kit	100410

FotoSan® 630 Agent vials, assorted box (2 x Low, 2 x Medium, 2 x High viscosity)	13850
FotoSan® 630 Agent vials, box of high viscosity	13806
FotoSan® 630 Agent vials, box of medium viscosity	13706
FotoSan® 630 Agent vials, box of low viscosity	13606

FotoSan® 630 Agent syringes, assorted box (1 x Low, 2 x Medium, 2 x High viscosity)	13855
FotoSan® 630 Agent syringes, box of high viscosity	13803
FotoSan® 630 Agent syringes, box of medium viscosity	13703
FotoSan® 630 Agent syringes, box of low viscosity	13603

FotoSan® 630 tips for light blunt 4 mm	100501
FotoSan® 630 tips for light blunt 8 mm	100502
FotoSan® 630 tips for light perio long 23 mm	100503
FotoSan® 630 tips for light perio short 15 mm	100504
FotoSan® 630 tips for light endo	100505

FotoSan® 630 cover	100510
--------------------	---------------

FotoSan® 630 Agent application tips 25 Gauge	100521
FotoSan® 630 Agent application tips 22 Gauge	100522

FotoSan® 630 protection glasses	13900
FotoSan® 630 protection glasses flip-up	13901

FotoSan 630 patient information	600034
---------------------------------	---------------

Keep your patients informed.
Request the material for your dental practice.



1. Bergmans L, Moisiadis P, Huybrechts B, Van Meerbeek B, Quirynen M, Lambrechts P. Effect of photo-activated disinfection on endodontic pathogens ex vivo. *International Endodontic Journal* 2008; 41: 227-239
2. Bonsor SJ, Nichol R, Reid TMS, Pearson GJ. Microbiological evaluation of photo-activated disinfection in endodontics (An in vivo study). *British Dental Journal* 2006; 6: 337-341
3. Braun A, Dehn C, Krause F, Jepsen A. Antimikrobielle Photodynamische Therapie (aPDT) bei der parodontalen Behandlung. *Quintessenz Team-Journal* 2007; 2: 63-68
4. Braun A, Dehn C, Krause F, Jepsen S. Short-term clinical effects of adjunctive antimicrobial photodynamic therapy in periodontal treatment: a randomized clinical Trial. *Journal of Clinical Periodontology* 2008; 35: 877-884
5. Chondros P, Nikolidakis D, Christodoulides N, Rössler R, Gutknecht N. An. Sculean Photodynamic therapy as adjunct to non-surgical periodontal treatment in patients on periodontal maintenance: a randomized controlled clinical trial. *Lasers in Medical Science* 2008; DOI 10-1007
6. De Oliveira RR, Schwartz-Filho HO, Novaes AB jr, Taba M jr. Antimicrobial photodynamic therapy in the non-surgical treatment of aggressive periodontitis: a preliminary randomized controlled clinical study. *Journal of Periodontology* 2007; 78: 965-973
7. Dobson J, Wilson M. Sensitization of oral bacteria in biofilms to killing by light from a low-power laser. *Archives of Oral Biology* 1992; 37: 883-887
8. Donnelly RF, McCarron PA, Tunney MM, Wolfson A. Potential of photodynamic therapy in treatment of fungal infections of the mouth. Design and characterisation of a mucoadhesive patch containing toluidine blue O. *Journal of Photochemistry and Photobiology B* 2007; 86: 59-69
9. Dörtbudak O, Haas R, Bernhart T, Mailath-Pokorny G. Lethal photosensitization for decontamination of implant surfaces in the treatment of peri-implantitis. *Clinical Oral Implants Research* 2001; 12: 104-108
10. Garcez AS, Nunez SC, Hamblin MR, Suzuki H, Riberio MS. Photodynamic therapy associated with conventional endodontic treatment in patients with antibiotic-resistant microflora: a preliminary report. *Journal of Endodontics* 2010; 36: 1463-1466
11. Garcez AS, Ribeiro MS, Tegos GP, Nunez SC, Jorge AO, Hamblin MR. Antimicrobial photodynamic therapy combined with conventional endodontic treatment to eliminate root canal biofilm infection. *Lasers in Surgery and Medicine* 2007; 39: 59-66
12. Haas R, Dörtbudak O, Mensdorff-Pouilly N, Mailath G. Elimination of bacteria on different implant surfaces through photosensitization and soft laser. An in vitro study. *Clinical Oral Implants Research* 1997; 8: 249-254
13. Haas R, Baron M, Dörtbudak O, Watzek G. Lethal photosensitization, autogenous bone, and e-PTFE membrane for the treatment of periimplantitis: preliminary results. *International Journal of Oral & Maxillofacial Implants* 2000; 15: 374-382

14. Hamblin MR, Hasan T. Photodynamic therapy: a new antimicrobial approach to infectious disease? *Photochemistry and Photobiology Science* 2004; 3: 436-450
15. Hope CK, Wilson M. Introduction of lethal photosensitization in biofilms using a confocal scanning laser as the excitation source. *Journal of Antimicrobial Chemotherapy* 2006; 57: 1227-1230
16. Jori G. Photodynamic therapy of microbial infections: state of the art and perspectives. *Journal of Environmental Pathology, Toxicology and Oncology* 2006; 25: 505-519
17. Kömerik N, Wilson M. Factors influencing the susceptibility of Gram-negative bacteria to toluidine O-mediated lethal photosensitization. *Journal of applied Microbiology* 2002; 92: 618-623
18. Kömerik N, Nakanishi H, MacRobert AJ, Henderson B, Speigh P, Wilson M. In vivo killing of *Porphyromonas gingivalis* by toluidine blue-mediated photosensitization in an animal model. *Antimicrobial Agents Chemotherapy* 2003; 47: 932-940
19. Konopka K, Goslinski T. Photodynamic therapy in dentistry. *Journal of Dental Research* 2007; 86: 694-707
20. Lee CF, Lee CJ, Chen CT, Huang CT. Delta aminolaevulinic acid mediated photodynamic antimicrobial therapy on *Pseudomonas aeruginosa* planktonic and biofilm cultures. *Journal of Photochemistry and Photobiology B* 2004; 75: 21-25
21. Maisch T. Anti-microbial photodynamic therapy: useful in the future?. *Lasers in Medical Science* 2007; 22: 83-91
22. Metcalf D, Robinson C, Devine D, Wood S. Enhancement of erythrosine-mediated photodynamic therapy of *Streptococcus mutans* biofilms by light fractionation. *Journal of Antimicrobial Chemotherapy* 2006; 58: 190-192
23. Neugebauer J, Karapetian V, Kübler AC, Zöller JE. Die antimikrobielle photodynamische Periimplantitistherapie. *Implantologie Journal* 2004; 6: 16-20
24. Neugebauer J. Photodynamische therapie der periimplantären mucositis. *Zahnmedizin implantologie* 2007; 03: 30-33
25. O'Neill JF, Hope CK, Wilson M. Oral bacteria in multi-species biofilms can be killed by red light in the presence of toluidine blue. *Lasers in Surgery and Medicine* 2002; 31: 86-90
26. Pfitzner A, Sigush BW, Albrecht V, Glockmann E. Killing of periodontopathogenic bacteria by photodynamic therapy. *Journal of Periodontology* 2004; 75: 1343-1349
27. Saji G, Kishen A. Advanced noninvasive light-activated disinfection: assessment of cytotoxicity on fibroblast versus antimicrobial activity against *Enterococcus faecalis*. *JOE* 2007; 5: 599-602
28. Seal GJ, Ng YL, Spratt D, Bhatti M, Gulabivala K. An in vitro comparison of the bactericidal efficacy of lethal photosensitization or sodium hypochlorite irrigation on *Streptococcus intermedius* biofilms in root canals. *International Endodontic Journal* 2002; 35: 268-274
29. Shibli JA, Martins MC, Theodoro LH, Lotufo RF, Garcia VG, Marcantonio EJ. Lethal photosensitization in microbiological treatment of ligature-induced peri-implantitis: a preliminary study in dogs. *Journal of Oral Science* 2003; 45: 17-23

30. Shibli JA, Martins MC, Riberio FS, Garcia VG, Nociti FH, Marcantonio E. Lethal photosensitization and guided bone regeneration in treatment of peri-implantitis: an experimental study in dogs. *Clinical Oral Implants Research* 2006; 17: 273-281
31. Sigusch BW, Pfitzner A, Albrecht V, Glockmann E. Efficacy of photodynamic therapy on inflammatory signs and two selected periodontopathogenic species in a beagle dog model. *Journal of Periodontology* 2005; 76: 1100-1105
32. Soukos NS, Mulholland SE, Socransky SS, Doukas AG. Photodestruction of human dental plaque bacteria: enhancement of the photodynamic effect by photomechanical waves in an oral biofilm model. *Lasers in Surgery and Medicine* 2003; 33: 161-168
33. Soukos NS, Chen PS, Morris JT, Ruggiero K, Abernethy AD, Som S, et al. Photodynamic therapy for endodontic disinfection. *Journal of Endodontics* 2006; 32: 979-984
34. Steiner R. New laser technology and future application. *Medical Laser Application* 2006; 21: 131-140
35. Teichert MC, Jones JW, Usacheva MN, Biel MA. Treatment of oral candidiasis with methylene blue-mediated photodynamic therapy in an immunodeficient murine model. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology & Endodontics* 2002; 93: 155-60
36. Williams JA, Pearson GJ, Colles MJ. Antibacterial action of photoactivated disinfection (PAD) used on endodontic bacteria in planktonic suspension and in artificial and human root canals. *Journal Den* 2006; 34: 363-371
37. Wilson M, Burns T, Pratten J. Killing of *Streptococcus sanguis* in biofilms using a light-activated antimicrobial agent. *Journal of Antimicrobial Chemotherapy* 1996; 37: 377-381
38. Wood S, Nattress B, Kirkham J, Shore R, Brookes S, Griffiths J, et al. An in vitro study of the use of photodynamic therapy for the treatment of natural plaque biofilms formed in vivo. *Journal of Photochemistry and Photobiology* 1999; 50:1-7
39. Wood S, Metcalf D, Devine D, Robinson C. Erythrosine is a potential photosensitizer for the photodynamic therapy of oral plaque biofilms. *Journal of Antimicrobial Chemotherapy* 2006; 57: 680-684
40. Zanin IC, Gonçalves RB, Junior AB, Hope CK, Pratten J. Susceptibility of *Streptococcus mutans* biofilms to photodynamic therapy: an in vitro study. *Journal of Antimicrobial Chemotherapy* 2005; 56: 324-330
41. Zanin IC, Lobo MM, Rodrigues LK, Pimenta LA, Hofling JF, Gonçalves RB. Photosensitization of in vitro biofilms by toluidine blue O combined with light-emitting diode. *European Journal of Oral Science* 2006; 114: 64-69

Manufactured in Denmark by:

