Photodynamic therapy with the new active ingredient Perio Green

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_Introduction

Indocyanine green combats pathogenic bacteria simply, effectively and without side effects.

Until now, systematic periodontal treatments have often required the additional use of systemic antibiotic medication as well as the normal manual treatment involving cleaning, curettage and after-care in order to eliminate treatment-resistant pathogens more effectively and to achieve a long-lasting therapeutic effect.

However, the administration of antibiotics is always associated with side effects which unfortunately cannot be avoided with classic therapy. In the following article, a case study will therefore be used to illustrate a new, gentle method of bacterial reduction in gingival pockets: minimally invasive photodynamic therapy (PDT) with indocyanine green (Perio Green, elexxion AG) which works without antibiotics and causes no systemic side effects or unsightly discolouration.

Fig. 1_Gingival redness with signs of inflammation.

In periodontology, the laser is frequently used as adjuvant therapy because of its bactericidal mode of action. Various studies using laser light to decontaminate gingival pockets have delivered promising results. Diode lasers (810 to 980 nm) with output levels of 1 to 2 watts are mostly used for this purpose. Depending on the practitioner's manual dexterity and experience, this laser adjuvant therapy can be performed without anaesthetic.

_Pain-free periodontal therapy without cytotoxic effects

Photodynamic therapy is a new and promising approach to eliminating periodontal pathogens and bacteria. Unlike laser application on its own, a photodynamic active ingredient (photosensitiser) is absolutely essential to this technique. This dye adheres to matrix proteins in the bacterial membrane and, when exposed to laser light of the corresponding wavelength, reacts with the release of free oxygen radicals. This singlet oxygen alters the plasma proteins so that they are unable to continue metabolising and hence die.

Correct use of the defined laser light source in combination with the photosensitiser is essential in this process. This means that the dye must be specifically coordinated with the wavelength used. If not, no absorption of the laser light takes place in the active ingredient. The energy settings employed lie within milliwatt range (mainly 100 mW) so that pain-free treatment is possible for patients.

A systemic effect (as with antibiotic administration) can be prevented completely by choosing the right photodynamic sensitiser. As the photosensitiser only docks onto the bacterial membrane, no side effects such as cytotoxic effects occur in endogenous cells. In

addition, no heating of the tissue ensues and there is no evaporation of tissue or bacterial residues; anaesthesia is usually unnecessary.

_Green photosensitiser leaves no dye residues

While blue PDT dyes such as methylene or toluidine blue were mainly used until recently, green photosensitisers such as indocyanine green are now available. As the green dye is used with diode lasers with 810 nm wavelength, it is not necessary to purchase a special laser for PDT—compared with blue dyes this is an economic advantage to dental practices that should not be underestimated.

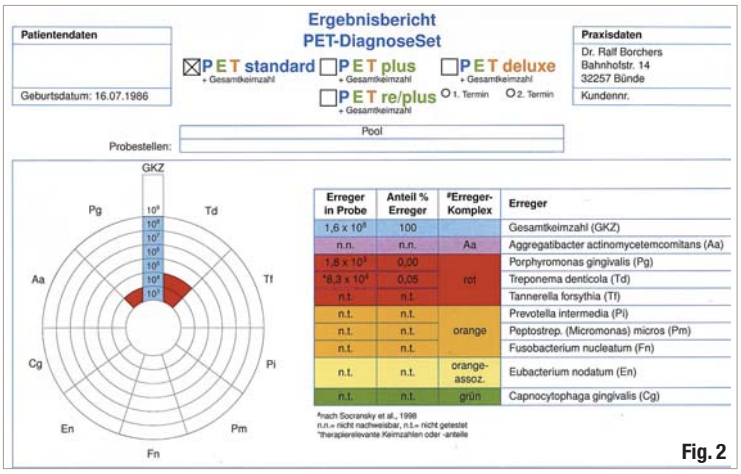


Fig. 2

Indocyanine green is a "true" photosensitiser which only reacts when the appropriate laser light is supplied but otherwise displays no therapeutic effect —neither negative nor positive. By contrast, the blue PDT active ingredients have a bacteriostatic or bactericidal action even without the supply of light; strictly speaking, therefore, they are not true photosensitisers.

Another disadvantage of methylene and toluidine blue: particularly in the anterior area, they continually cause prolonged blue discolouration of the tissue and/or teeth, which patients find extremely unsightly. Indocyanine green deals with this problem because the sensitiser as a unique laser-activatable ingredient has the property of coupling selectively to bacterial cells while at the same time it is far easier to rinse off with water than the "blue products" found on the market.

The indocyanine green that is used as the raw material for the new Perio Green is identical to the dye that

Fig. 2_The microbiological test shows the bacterial spectrum in the reddened area.

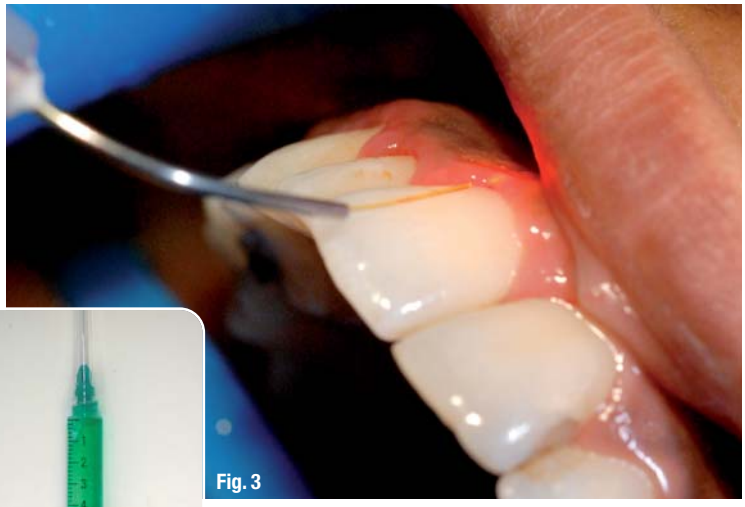


Fig. 3

Fig. 4

Fig. 3_Drawing up the resulting laser-activatable dye solution into a disposable syringe.
Fig. 4_Pulsed light activation with the elexxion laser.

has been used successfully in medical diagnostics for many years and is licensed worldwide. In other words, the photosensitiser by elexxion is clinically safe and furthermore is a certified class IIa medical device. The use of Perio Green in combination with a diode laser of a wavelength of 810 and variable pulsing (claros, elexxion) is presented below.

_Initial situation

The patient was treated by me for severe periodontal disease (pocket depths from 5 to 7 mm) and had already received conservative treatment (professional tooth-cleaning, education and motivation, debridement and curettage of pockets plus ultrasonic rinsing). Nevertheless, clearly visible gingival redness with signs of inflammation persisted (Fig. 1). Microbiological testing revealed a remaining bacterial spectrum in the reddened area (Fig. 2). Such refractory cases inevitably lend themselves to treatment with antibiotics. After a detailed discussion with the patient, however, we opted for an alternative that would be freer of side effects: photodynamic therapy.

Fig. 5_The microbiological germ identification after PDT shows that the micro-flora was eliminated effectively.

Fig. 5

Ergebnisbericht
PET-DiagnoseSet

Patientendaten

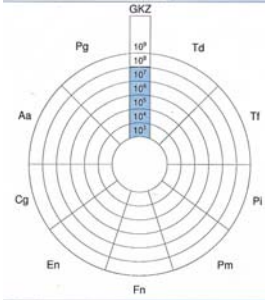
Geburtsdatum: 16.07.1986

Praxisdaten
Dr. Ralf Borchers
Bahnhofstr. 14
32257 Bünde
Kundennr.

☒PET standard + Gesamtkeimzahl ☐PET plus + Gesamtkeimzahl ☐PET deluxe + Gesamtkeimzahl
☐PET re/plus + Gesamtkeimzahl ○1. Termin ○2. Termin

Probestellen: Pool

GKZ



Erreger in Probe	Anteil % Erreger	#Erreger-Komplex	Erreger
1,9 x 10^7	100		Gesamtkeimzahl (GKZ)
n.n.	n.n.	Aa	Aggregatibacter actinomycetemcomitans (Aa)
n.n.	n.n.	rot	Porphyromonas gingivalis (Pg)
n.n.	n.n.	rot	Treponema denticola (Td)
n.t.	n.t.	rot	Tannerella forsythia (Tf)
n.t.	n.t.	orange	Prevotella intermedia (Pi)
n.t.	n.t.	orange	Peptostrep. (Micromonas) micros (Pm)
n.t.	n.t.	orange	Fusobacterium nucleatum (Fn)
n.t.	n.t.	orange-assoz.	Eubacterium nodatum (En)
n.t.	n.t.	grün	Capnocytophaga gingivalis (Cg)

#nach Socransky et al., 1998
n.n.= nicht nachweisbar, n.t.= nicht getestet
*therapierelevante Keimzahlen oder -anteile

Befund: Die getesteten Erreger waren nicht nachweisbar. Daher kann kein antibiotischer Wirkstoff empfohlen werden. Wenn eine Prä-Implantations-Diagnostik durchgeführt wurde, sind wahrscheinlich keine zusätzlichen Therapieschritte notwendig. Wenn eine klinisch apparente Parodontitis vorliegt, sind möglicherweise eine rein mechanische Therapie (SRP) aus. Hinweis: bei durchschnittlich ca. 20-25% der Proben, bei denen weder Aa, Pg noch Td nachgewiesen wurden, liegen andere Erreger (z.B. Tf, Pi usw.) in therapierelevant erhöhten Keimzahlen oder Keimanteilen vor.

Blatt 1 von 2

_Photodynamic therapy

As the photosensitiser mixed into Perio Green is only effective for about two hours, the tablet was dissolved in sterile water only shortly before treatment was carried out. The resulting laser-activatable dye solution was drawn up into a disposable syringe (Fig. 3), then spread into the gingival pockets by a thin, blunt application tip. Owing to the low viscosity of the active ingredient, penetration down to the floor of the pocket is guaranteed. After two minutes' exposure to the solution and subsequently rinsing of the mouth, pulsed light activation was performed with the elexxion laser. To do this, a laser fibre 200 to 300 µm in diameter was inserted into the pocket and the active ingredient was irradiated for 30 seconds (Fig. 4).

_After-care

The patient came back a week later for recall when another Perio Green treatment was carried out. Microbiological testing to identify germs was repeated under the same conditions as the first test in order to monitor the success of the treatment. The results of the test (Fig. 5) suggest that the new active ingredient Perio Green in combination with the specific laser light of the elexxion laser is a suitable tool for effective elimination of micro-flora.

_Conclusion

The photodynamic therapy with indocyanine green presented here is not only effective at combatting bacteria in the oral cavity, but it is also free of side effects, offers uncomplicated handling for practitioner and patient and involves minimal treatment time (approx. 45 minutes for a complete UJ/LJ treatment). Other patient treatments performed in my practice as well as current clinical trials with Perio Green also confirm the success of this minimally invasive form of therapy. Thus the positive aspects of indocyanine green treatment were presented in detail by several speakers during the DGL (German Association for Laser Dentistry) and LEC congress (Laser Beginners Congress) held last year in early September in Leipzig, Germany._

_contact laser

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