

it is known as the gold standard therapy. The disruption of the subgingival biofilm, which reduces the bacterial load and results in a delay in repopulation by pathogenic microbes is the most important benefit of SRP but new studies have shown a superior effect when it is associated with diode laser or photodynamic therapy.

The aim of this study is to compare the clinical attachment level (CAL) gain when we use SRP alone and associated to photodynamic therapy using different photosensitizers at different concentrations.

Forty patients received conventional treatment (ultrasound only) in two hemiarches (maxillary and mandibular) and tested protocol on the two other hemiarches.

The experimental PDT groups were: Group 1, Photogem® at 100 µg/ml (PHO1)+LED 630 nm; Group 2, Photogem® 1 mg/ml (PHO2)+LED 630 nm; Group 3, Curcumin 1.5 mg/ml (Curc)+LED 460 nm; Group 4, nanoparticules methylene blue (nano)+LED 630 nm.

Using a commercial available ultrasound system (Gnatus Jet sonic Plus) a special device was developed and coupled to the transducer hand held. Two light sources (red light LED 630 nm or blue LED 460 nm) result in illumination intensity at the treated region around 20 mW/cm².

CAL was evaluated at baseline, 1 month post treatment and 3 month post treatment.

All tested groups presented better results when compared to the control group for CAL and the best result was for the protocol used at Group 2 (PHO2 = 1 mg/ml).

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Photodynamic antimicrobial therapy associated with surgical endodontic treatment

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In the past decades there were advances in endodontic treatment, such as rotatory instruments, microscopy, ultrasonic instrumentation and improved root-filling materials. There are, however, situations in which surgery is necessary to retain a tooth that otherwise would be extracted due to insufficient decontamination leading to a persistent infection. The aim of this study was to compare the microbial reduction after conventional periapical surgery followed by photodynamic therapy (PDT) as an adjuvant antimicrobial treatment. Twenty-eight teeth needing periapical surgery were enrolled in this study. Microbiological samples were taken (1) after accessing the bone lesion, (2) after surgical procedure, and (3) after PDT. The teeth received, a full mucoperiosteal flap, osteotomy with a high-speed bur, manual curettage of periapical lesion and the external surface of the root, root-end resection of 2–3 mm with no bevel, retrograde cavities prepared using ultrasonic retro-tips to a 3 mm depth. After the conventional procedure the cavities received an aqueous solution of methylene blue (60 µM, 3 min) and were irradiated with a diode laser $\lambda = 660$ nm (6 min – 15 J). After PDT, the procedure was conventionally ended by a retrograde filling with mineral trioxide aggregate, flap re-positioning, and sutures. The microbiological samples showed an overall significant reduction, surgical procedure achieved a mean reduction of about 3.5 log while PDT achieved a 5 log reduction. It appears that surgical endodontic treatment associated with photodynamic therapy highly improves the microbial reduction compared to the

traditional technique and this could directly affect the treatment prognosis.

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Formulation of novel colon specific delivery devices for photodynamic antimicrobial chemotherapy (PACT)

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Colon-residing bacteria such as vancomycin-resistant *Enterococcus faecalis* and *Bacteroides fragilis* can cause a range of serious clinical infections. Photodynamic antimicrobial chemotherapy (PACT) may be a novel treatment option for these multi-drug resistant organisms. The aim of this study was to formulate a drug delivery system that could be used to target release of photosensitizer in the colon and determine susceptibility of *Enterococcus faecalis* and *Bacteroides fragilis* strains to PACT mediated by methylene blue (MB), meso-tetra (N-methyl-4-pyridyl) porphine tetra tosylate (TMP), or 5-aminolevulinic acid hexyl-ester (h-ALA).

Formulations containing 5% loading of either MB, TMP or h-ALA were prepared via hot melt extrusion. Drug release from the formulations was determined over a 6 h period using the British Pharmacopoeia (BP) method for drug release from controlled release formulations. Planktonic cultures of *E. faecalis* and *B. fragilis* were exposed to PACT mediated by the MB, TMP and h-ALA under anaerobic conditions.

Results show that, for MB, an average of 30% of the total drug load was released over a 6 h period. For TMP and h-ALA, these values were 50% and 16% respectively. No drug was released in the acidic media. Levels of *E. faecalis* and *B. fragilis* were reduced by up to 4.67 and 7.73 logs respectively on PACT exposure under anaerobic conditions.

The results indicate that photosensitizer release could be targeted to the colon *in vivo* and that colon-residing pathogens are susceptible to PACT mediated by the compounds used. PACT remains a potential treatment of recalcitrant colon infection.

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Immobilized metallophthalocyanines and fullerene C₆₀ for inactivation of pathogenic microorganisms

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Photodynamic therapy for inactivation of pathogens is an innovative method with advantages of the local treatment and not development of microbial resistance to the photosensitizers. In the present study, we propose a solid material containing photodynamic sensitizers embedded into polypropylene granules (Fig. 1). It can be used as multiple photocatalyst in inactivation of pathogenic cells. The new particles are based on the photodynamically active metal phthalocyanines and fullerene C₆₀, both immobilized on polypropylene granules. The particles were characterized by the methods of