

Clinical Data

blue[®]m oxygen technology

Protection for natural teeth and implants. Accelerating wound healing, implant integration and bone regeneration in a safe, effective and non-invasive approach.

- Works instantaneously
- Effective on all micro organisms
- No resistance developed
- No side effects
- No toxic ingredients
- Simple concept

Wound healing

Wound healing requires a variety of cells to increase their metabolic activity, resulting in a high oxygen demand.¹ Oxygen at the wound site has been shown to promote wound healing by stimulating several processes, including;

- Neovascularization²
- Collagen production^{3,4,5}
- Phagocytosis (engulfing of microorganisms, cells, or debris by macrophages or neutrophils)^{6,7}
- Neutrophil-mediated oxidative microbial killing⁷
- Degradation of necrotic wound tissue⁸

Lack of sufficient oxygen (hypoxia) has been associated with pain in the wound area, with the prevalence of hypoxia being more pronounced in patients who are smokers and diabetics. These populations demonstrate slower wound healing and increased risk of wound healing complications compared to healthy patients.^{9,10,11}

blue[®]m mechanism of action

blue[®]m is using a mechanism to deliver active oxygen (H₂O₂) in a controlled manner directly to the treatment site. In contact with saline Sodium perborate is converted into sodium borate and H₂O₂. In low concentrations of 0.003%- 0.015%, hydrogen peroxide has a disinfectant⁸ action, and occurs, together with the antibacterial ROS (reactive oxygen species) during the respiratory burst of neutrophils in normal wound fluid^{12,13} and has a chemotactic effect on leucocytes¹⁴ The concentrations of hydrogen peroxide in the blue[®]m products used are not comparable to the high concentrations (1.5 – 3%) of hydrogen peroxide used in medicine as a disinfectant. It is known that the production of free radicals then causes damage to the wound.^{19,15} Research has shown that the continuous presence of a low concentration of hydrogen peroxide kills pathogenic bacteria much more effectively than a one-off high concentration¹⁶ and that fibroblasts are not damaged by this.¹⁷

Function of the blue[®]m ingredients:

- **Accelerated tissue remodeling: Sodium Perborate²¹ & Honey²²**

Application of blue[®]m (oral gel) to injured tissues accelerates wound healing. Tissue oxygenation at peri-implantitis sites was significantly decreased ($p < 0.05$) when compared with that at healthy sites.²⁰.

- **Plaque control: Sodium Perborate^{23,24} Honey²⁵ and Xylitol^{27,28}**

Oxygen molecules (O^2) can penetrate much deeper into the biofilm to kill the anaerobic bacteria than the Chlorhexidine ($C_{22}H_{30}Cl_2N_{10}$) molecule.

Oxygen molecule (O^2) can penetrate much deeper into the perimucosal seal around

the implant.

- **Bone growth accelerator: Lactoferrin^{29,30}.**

Lactoferrin potently stimulates the proliferation and differentiation of primary osteoblasts.

Relative Dentin Abrasion (RDA <30)³⁵:

blue[®]m toothpaste has a neutral pH value and contains no scouring ingredients. Therefore no damage can be caused to the surfaces of teeth or implants.

Fluoride:

Most blue[®]m products are Fluoride-free. Fluoride impairs the corrosion^{31,32,33,34} resistance of the titanium implants. Due to the corrosion microscopic particles of titanium can be found in the surrounding tissue, which may have a negative impact on the devices, as this can potentially be pro-inflammatory.

Treatment indications

- Acute wound healing after implant placement
- Gingivitis³⁷
- Periodontitis³⁶
- Peri-implant mucositis
- Peri-implantitis³⁶
- Pericoronitis
- Oral Ulcers
- Pemphigus Vulgaris³⁹

Different concentrations of slow oxygen release

- blue[®]m toothpaste 75 ml +/- 20 mg / l O₂
- blue[®]m mouthwash 500 ml +/- 20 mg / l O₂
- blue[®]m oral spray 15 ml +/- 20 mg / l O₂
- blue[®]m oral gel 15 ml > 100 mg / l O₂
- blue[®]m oral foam 100 ml +/- 20 mg / l O₂
- blue[®]m oxygen fluid 500 ml +/- 40 mg / l O₂

Literature

1. Eisenbud DE. Oxygen in Wound Healing. Clin Plastic Surg 39 2012: 293-310
2. Hopf HW, Gibson JJ, Angeles EP et al. Hyperoxia and angiogenesis. Wound Repair Regen 2005; 13:558-64
3. Niinikoski J. Effect of oxygen supply on wound healing and formation of experimental granulation tissue. Acta Physiol Scand Suppl. 1969;334:1-72.
4. Hunt TK, Pai MP. The effect of varying ambient oxygen tensions on wound metabolism and collagen synthesis. Surg Gynecol Obstet. 1972;135(4): 561-567.
5. Hsu RW, Hsu WH, Tai CL, Lee KF. Effect of hyperbaric oxygen therapy on patellar tendinopathy in a rabbit model. J Trauma. 2004;57(5):1060-1064

6. Hohn DC, MacKay RD, Halliday B, Hunt TK. The effect of O₂ Surg Forum. 1976; 27(62):18-20.
7. Sen CK. Wound healing essentials: let there be oxygen. *Wound Repair Regen* 2009; 17:1-18
8. Dalton SJ, Whiting CV, Bailey JR, Mitchell DC, Tarlton JF. Mechanism of chronic skin ulceration linking lactate, transforming growth factor-beta, vascular endothelial growth factor, collagen remodeling, collagen stability, and defective angiogenesis. *J Invest Dermatol.* 2007;127(4):958-968.
9. Silverstein, P. "Smoking and wound healing. *Am. J. Med.*, 1992;93 (Suppl 1A):22S-24S.
10. Carrico TJ, Mehrhof AI, Cohen IK. "Biology of wound healing." *Surg Clinics of North America.* 1984;64(94):721-733.
11. Cruse PJE, Foord R. "A prospective study of 23,649 surgical wounds." *Arch Surg.* 1973;107:2006-210.
12. Sashwati R, Savita K, Kishore N, Thomas K. Dermal wound healing is subject to redox control. *Mol Ther* 2006; 13: 211-220 2.
13. Fife CE, Buyukcakir C, Otto GH et al. The predictive value of transcutaneous oxygen tension measurement in diabetic lower extremity ulcers treated with hyperbaric oxygen therapy: a retrospective analysis of 1,144 patients. *Wound Repair Regen* 2002; 10:198-207
14. Cho M, Hunt TK, Hussain MZ. Hydrogen peroxide stimulates macrophage vascular endothelial growth factor release. *Am J Physiol Heart Circ Physiol* 2001; 280: H2357-H2363
15. Sen CK. Wound healing essentials: let there be oxygen. *Wound Repair Regen* 2009; 17:1-18
16. Saissy JM, Guignard B, Pats B et al. Pulmonary edema after hydrogen peroxide irrigation of a war wound *Intens Care Med* 1995; 21:287-288
17. Pruitt KM, Reiter B. Biochemistry of peroxidase system: antimicrobial effects in the lactoperoxidase system. New York 1985: 143
18. Hyslop PA, Hinshaw DB, Scraufstatter IU et al. Hydrogen peroxide as a potent bacteriostatic antibiotic: implications for host defence. *Free radical Biology and Medicine* 1995; 19:31-7
19. Sashwati R, Savita K, Kishore N, Thomas K. Dermal wound healing is subject to redox control. *Mol Ther* 2006; 13: 211-2
20. On site noninvasive assessment of peri-implant inflammation by optical spectroscopy. *J Periodontal Res.* 2011 Jun;46(3):382-8
21. Nascent oxygen from sodium perborate in oral disinfection and hygiene *Odontoiatr Rev Iberoam Med Boca.* 1950;7(83):617-50.
22. Honey: An immunomodulator in wound healing *Wound Rep Reg* (2014) 22 187-192
23. Effect of an oxygenating agent on oral bacteria in vitro and on dental plaque composition in healthy young adults *Frontiers in Cellular and Infection Microbiology* July 2014, Volume 4
24. The effect of chemotherapeutic agents on titanium-adherent biofilms. *Clin. Oral Implants Res.* 22, 1227-1234
25. Effect of honey in preventing gingivitis and dental caries in patients undergoing orthodontic treatment *The Saudi Dental Journal* (2014) 26, 108-114
26. A Comparative Evaluation of the Antibacterial Efficacy of Honey In Vitro and Antiplaque Efficacy Preliminary Results *J Periodontol* • September 2012
27. Xylitol inhibits inflammatory cytokine expression induced by lipopolysaccharide from *Porphyromonas gingivalis*. *Clin Diagn Lab Immunol.* 2005 Nov; 12(11):1285-91.
28. Effect of xylitol on an in vitro model of oral biofilm. *Oral Health Prev Dent.* 2008;6(4):337-41.
29. Lactoferrin – A Novel Bone Growth Factor *Clin Med Res.* 2005 May; 3(2): 93-101.
30. Lactoferrin promotes bone growth *Biometals.* 2004 Jun;17(3):331-5.
31. The effect of fluoride ions on the corrosion behaviour of Ti metal, and Ti6-Al-7Nb and Ti-6Al-4V alloys in artificial saliva. *Acta Chim Slov.* 2013;60(3):543-55.
32. Effect of Fluoride Concentration and pH on Corrosion Behavior of Titanium for Dental Use. *J DENT RES* 1999 78: 1568
33. The role of fluoride on the process of titanium corrosion in oral cavity. *Biometals* (2012) 25:859-86234. *Biomedical Implants: Corrosion and its Prevention - A Review Recent Patents on Corrosion Science*, 2010, 2, 40-54
35. The measurement in vitro of dentine abrasion by toothpastes. *Int Dent J.* 2007 Oct;57(5):314-8.
36. Adjunctive topical Reactive Oxygen Species (ROS) in periodontitis and peri-implantitis – a pilot study

37. Application of toothpaste and mouthwash "blue@M" in complex hygienic oral care for patients with coronary heart disease Stomatologija (Mosk). 2014;93(3):18-20
38. Optimization of hygienic oral care in patients with dental implants based on use of toothpaste and mouthwash "blue@M" Stomatologija (Mosk). 2014
39. Use of oral hygiene products containing active oxygen in patients with pemphigus vulgaris Stomatologija (Mosk). 2014

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