

# Antioxidants in Oral Care

IEPSC Member Presentation  
Oct. 10, 2014  
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# Top 20 Antioxidant-Packed Foods

Consider this your shopping list of power foods, based on their total antioxidant capacity (TAC) per serving (1 piece fruit/potato, 1/2 cup beans/dried fruit, 1 cup berries/artichoke hearts, 1 ounce nuts).



Food	TAC
Small Red Beans	13,727
Wild Blueberries	13,427
(Red) Kidney Beans	13,259
Pinto Beans	11,864
Cultivated Blueberries	9,019
Cranberries	8,983
Artichokes	7,904
Blackberries	7,701
Dried Plums (Prunes)	7,291
Raspberries	6,058
Strawberries	5,938
Red Delicious/Granny Smith Apple	5,600
Pecans	5,095
Sweet Cherries	4,873
Black Plums	4,844
Russet Potato	4,649
Black Beans	4,181
Plums	4,118
Gala Apple	3,903
Walnuts	3,846

# QUESTIONS

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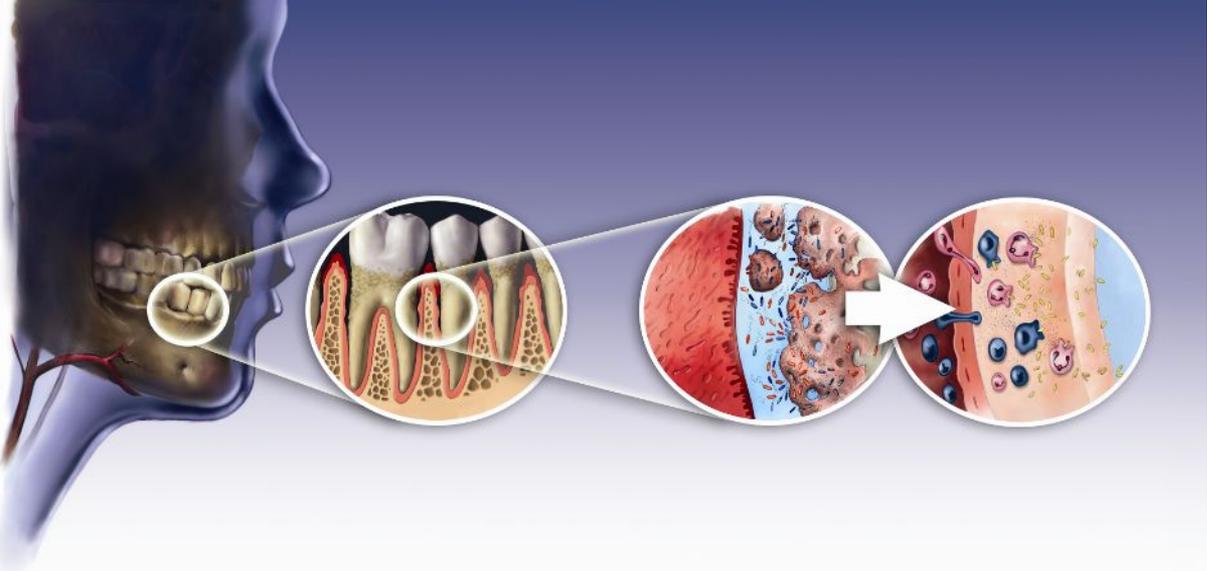
Regardless of the marketing method, does the product have merit?

Do my “natural remedy” patients have something to offer, besides my skepticism?

Is there new research about antioxidants or supplements that could enhance my patient care?

What does the literature say about antioxidants and their role in dentistry?

**Most of the focus involved the role antioxidants play in periodontal disease and the mechanisms involved in the inflammation process.**



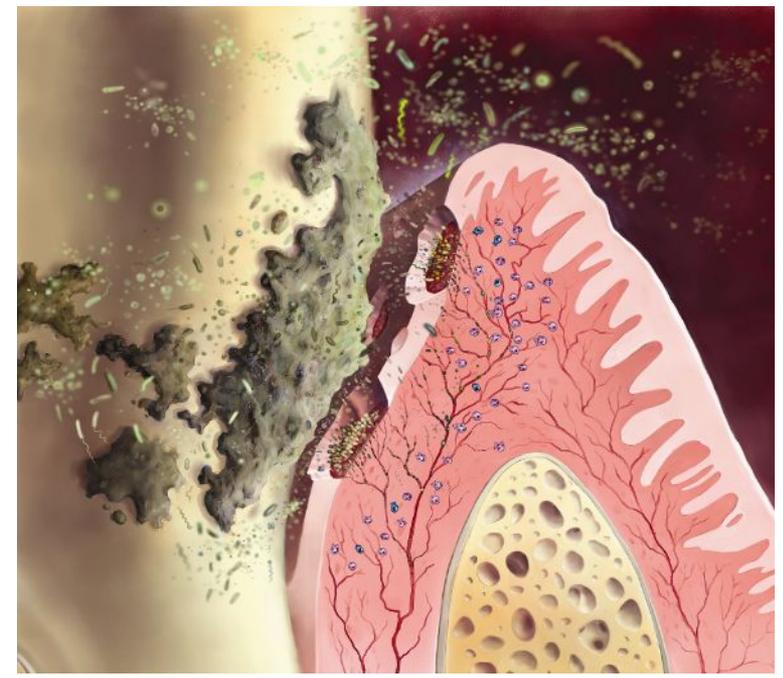
**Tissues respond to all negative stimuli by inciting the inflammation process.**

## INTRAORAL INFLAMMATION

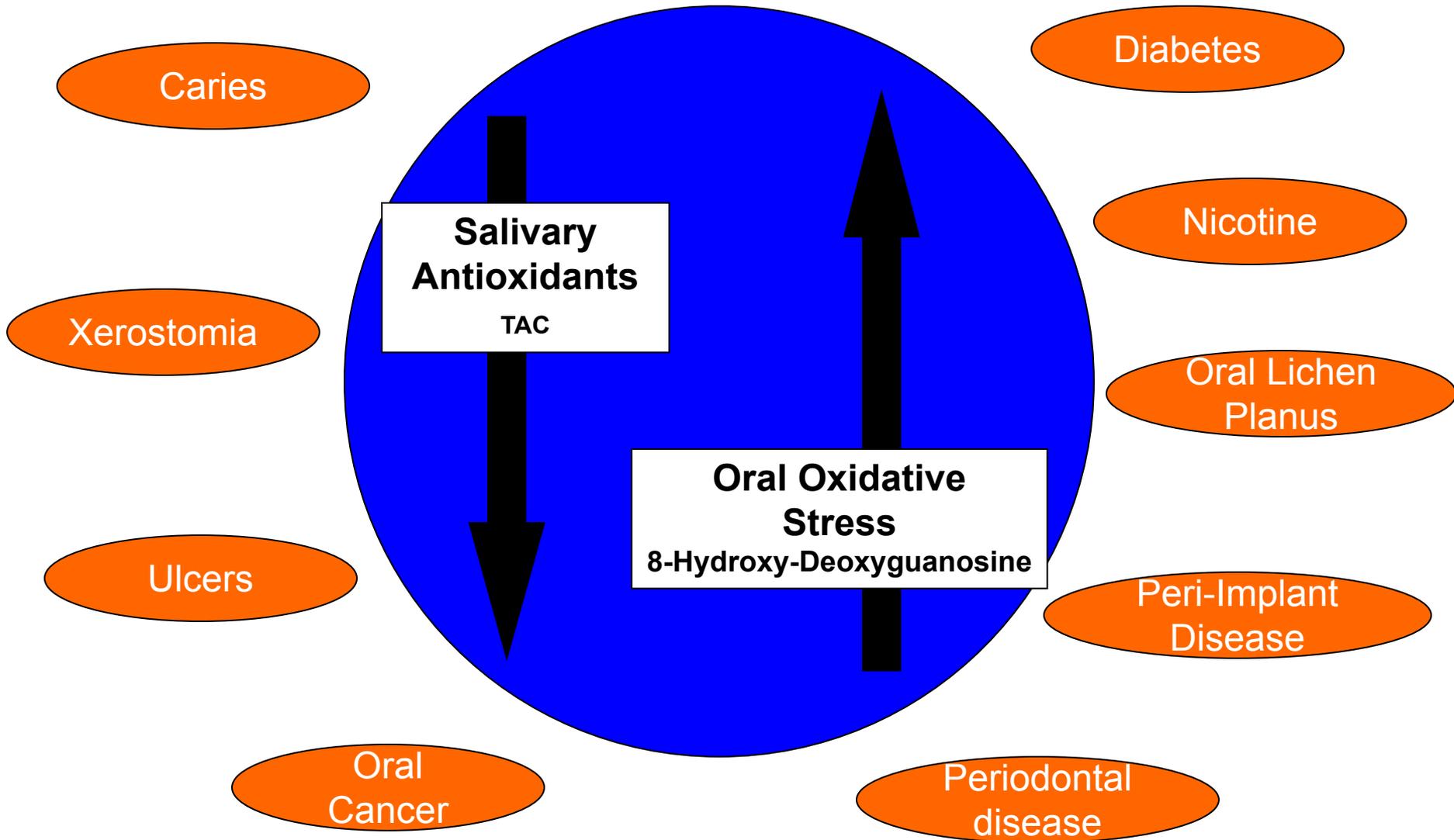
- 1. Bacteria
- 2. Host response

“Oxidative stress stays at the heart of periodontal damage that happens from host-pathogen interactions.” [S. Aksakalli, Dentistry 2013 4:1](#)

“The challenge of the future is in the harnessing of a resolution to inflammation for the treatment of chronic inflammatory diseases”. [Thomas Van Dyke, J. Periodontal, April 2014](#)



# INTRAORAL INFLAMMATION



# ANTIOXIDANT REVIEW

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- Molecules that can inhibit oxidation of other molecules
- Oxidation of molecules produces free radicals = harmful chain reactions
  - Cell death
  - Carcinogenesis
  - Low-density lipoproteins in cardiovascular disease
  - Many diseases associated
- Majority of free radicals are O<sub>2</sub> free Reactive Oxygen Species (ROS)
- Antioxidants neutralize the free radical through an enzymatic process.

# Salivary Antioxidants and Periodontal Disease

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2003: Low salivary antioxidant levels are associated with periodontal disease.

2011: **It has been now made clear** that the equilibrium between the free radicals/ROS and antioxidants is the main prerequisite for healthy periodontal tissue.

[1. Iain Chapple, Journal of the American Dental Association, 2003](#)

[2. P. Dahiya, et. al.; "Oxidative stress in chronic periodontitis," Review Article 2011, Vol 2. Chronicles of Young Scientists](#)

[3. R. V. Chandra, et. al.; "Efficacy of lycopene as a locally delivered gel in the treatment of chronic periodontitis: smokers vs nonsmokers," Quintessence International, Vol 43. May 2012](#)



# Salivary Antioxidants and Peri-Implant Disease

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Total Antioxidant Status (TAS) of saliva is significantly decreased in patients with peri-implant disease.

Oxidative stress and inflammatory markers (cytokines) may be an important factor contributing to the destruction of peri-implant tissues.

[S. Liskmann, et. al., "Characterization of the antioxidant profile of human saliva in peri-implant health and disease." Clinical Oral Implants Research February 2007](#)

[R. L. W. Messer, et. al., "Cytokine Secretion from monocytes persists differentially after activator removal - one mechanism of long-term biological response to implants." Journal of Biomedical Materials Research, Oct. 2007](#)

[M. L. Paperella, et. al., "Oral Mucosa Tissue Response to Titanium Cover Screws." J Periodontal August 2012](#)



# Salivary Antioxidants and Oral Lichen Planus

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TAC was significantly lower in Oral Lichen Planus patients compared with controls, indicating a significant oxidative process in the oral cavity.

Salivary antioxidant ability in patients with recurrent aphthous ulcerations is impaired.



[Daniela Miricescu, et al., \*Therapeutics, Pharmacology and Clinical Toxicology\*, June 2011](#)

[Assessment of salivary and serum antioxidant vitamins and lipid peroxidation in patients with recurrent aphthous ulceration. Saral Y, Coskun BK, et. al., \*The Tohoku Journal of Experimental Medicine\* Aug. 2005.](#)

# Salivary Antioxidants and Nicotine

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**Nicotine may play a pivotal role in the pathogenesis of oral disease by destruction of the salivary antioxidant systems.**



[R. Nagler et. al.; IMAJ 2004, Vol. 6, 691-694](#)

[R. Malhotra, et. al., "Nicotine and Periodontal Tissues," Journal of Indian Society Periodontol Jan-Mar 2010](#)

# Salivary Antioxidants and Dental Caries

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Salivary antioxidants level was lower among old adults compared to middle-aged ones and correlated with higher rates of caries in older adults



[Salivary antioxidants and physicochemical characteristics related to dental caries experience among a group of old adults. B.A. Yas, B. S. Diab et. al., Journal of Baghdad College of Dentistry 2009](#)

# Salivary Antioxidants and Xerostomia

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An increase in ROS-induced oxidative DNA damage was found in minor salivary glands in xerostomia patients.

Antioxidant administered before and after irradiation, prevented and restored radiation-induced salivary gland dysfunction in human salivary gland cells

[M. Kuraji, et. al. Oral Therapeutics and Pharmacology 2012.](#)

[Nagler, Salameh, Reznick, et al. Rheumatology 2003](#)

[Tai, Inoue, Yamada, Morito et al. Radiat Res 2009](#)

[Ma, Derossi, Ogbureke, Dickenson, et al. IADR, 2011](#)

# Salivary Antioxidants and Oral Cancer

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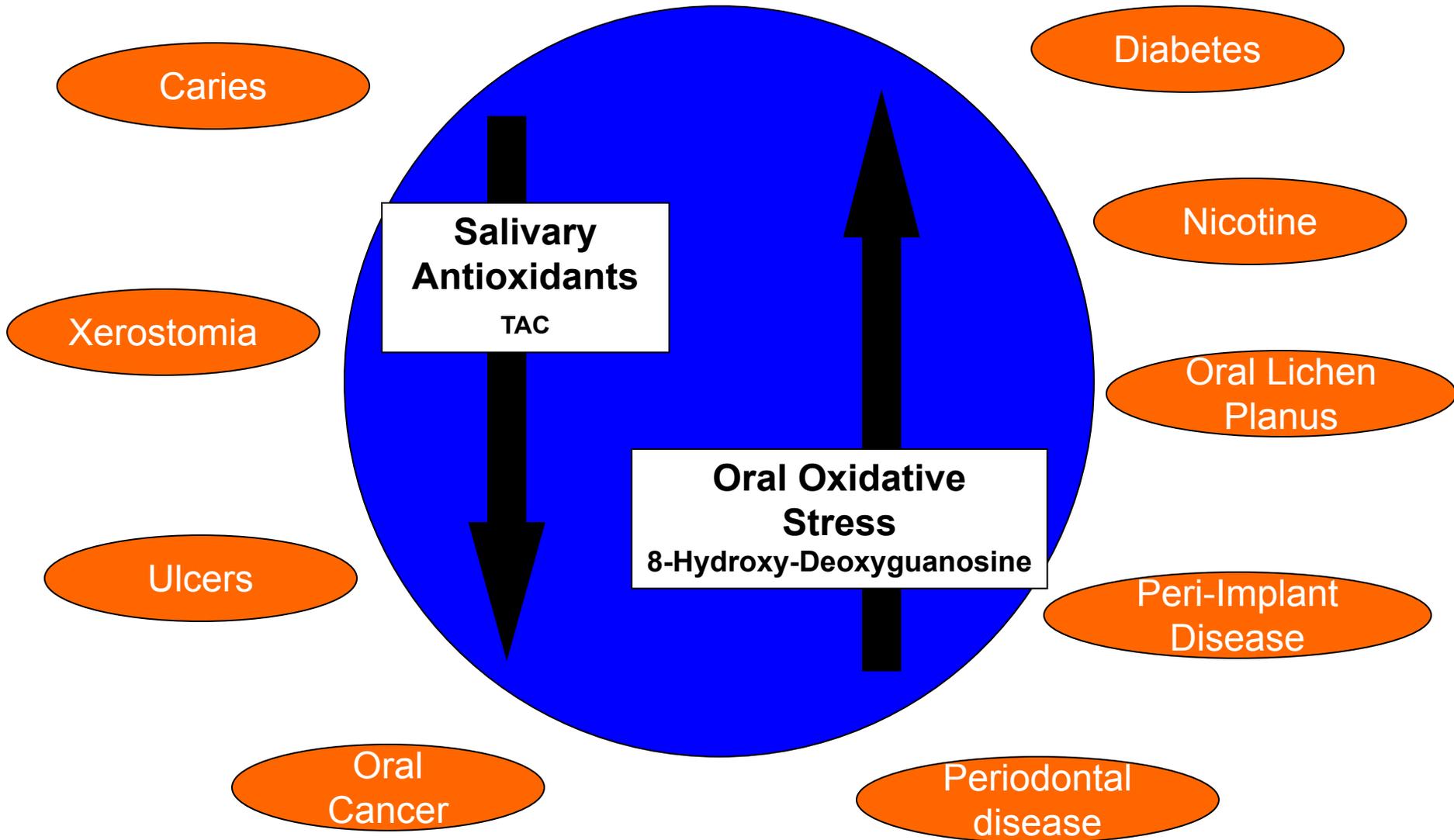
The increase in Free Radicals lowers salivary antioxidants which increases oxidative damage to DNA and proteins which may promote oral squamous cell carcinoma.

[Bahar G, et al. \*Cancer\*, 2007](#)

“Administration of local antioxidants to the oral cavity should be considered”

[Hersckovich O, \*The Journal of Gerontology\*, 2007](#)

# INTRAORAL INFLAMMATION



# OXIDATIVE STRESS & Polyphenols

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1. MICROBIAL CHALLENGE (bacteria is introduced)
  - Antigens and Lipopoly-saccharides
2. HOST IMMUNO-INFLAMMATORY RESPONSE (body's response)
  - Antibodies and PMN's push back against the microbes
  - Cytokines and Chemokines initiate bone metabolism and connective tissue furthering the inflammation process.
3. Fibroblasts proliferate and wound healing takes place (hopefully)
4. Or disease wins

Polyphenols show promise in this process by affecting it in three ways.

# POLYPHENOLS

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- **Polyphenols (Antioxidants)**

- A. Reduce Cytokines and Chemokines

- [Fordham J., Naqvi A, et. al.; "Leukocyte Production of Inflammatory Mediators Is Inhibited by the Antioxidants Phloretin, Silymarin, Hesperetin, and Resveratrol" Mediators of Inflammation 2014.](#)

- B. Neutralize Reactive Oxygen Species and Reduce Oxidative Stress

- [San Miguel S., Svoboda K., et. al.; "Bioactive Polyphenol Antioxidants Protect Oral Fibroblast From ROS Inducing Agents," Archives of Oral Biology 2012.](#)

- C. Proliferate Fibroblast and Accelerate Wound Healing

- [San Miguel S., Svoboda K., et. al.; "Bioactive Antioxidants Mixtures Promote Proliferation And Migration On Human Oral Fibroblasts," Archives of Oral Biology 2011](#)

- [San Miguel S., Svoboda K., et. al.; "Antioxidants Counteract Nicotine and Promote Migration via RacGTP in Oral Fibroblast Cells," J Periodontal 2010.](#)

# POLYPHENOLS (cont)

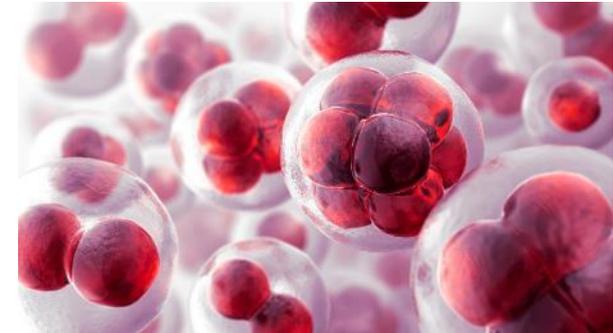
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- “Considerable body of literature supports a role for oxidative stress in the pathogenesis of age-related human diseases and a contribution of dietary polyphenols to their prevention”

[A. Scalbert. et. al.; American Journal of Clinical Nutrition](#)

- “ Direct and indirect evidence support the preventive polyphenol effect against oral cancer **with good evidence**. Consistent studies showing that **polyphenols inactivate periodontal pathogens** and suggest a preventive effect against periodontal disease with **fair evidence**.”

[S. Petti, et. Al.; “Polyphenols, Oral Health and Disease: A Review”. Journal of Dentistry, 2009.](#)



- Polyphenols adhere to the mucosal wall, can be retained for long periods and can function as slow releasing devices positively affecting the oxidative stress reactions in the mouth.

[I. Ginsburg, et. al.; “The Oxidant-Scavenging Abilities in the Oral Cavity May Be Regulated by a Collaboration Among Antioxidants in Saliva, Microorganisms, Blood Cells, and Polyphenols: A Chemiluminescence-Based Study” PLOS One, 2013](#)

# A product we are trying

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## INGREDIENTS:

- Antioxidants
  - A. Ferulic Acid – found in leaves and seeds
  - B. Phloretin – apples
  - C. Polyphenolic antioxidants
- Menthol, Thymol, and Essential Oils
- Xylitol (10%) – inhibition of S. Mutans

Anyone else using this product or one similar?  
Successes? Feedback?



# Before and Afters

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**Baseline**

**8 Days**

41-year-old female patient complained of gingival tenderness and swelling on the lower left side. Radiographs were negative, and 4-5 mm "pseudo-pocketing" was noted between teeth #19 and 20.

Following twice daily gel application for 8 days, the marginal swelling and inflammation resolved, the tissue is no longer tender, and the probing depth decreased to 3mm.

Dentist: Ron Bosher, DDS  
Plano, TX

# Before and Afters (cont)

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Baseline



Week 6

Patient Stats: Male, 43, Frequent smokeless tobacco user, Moderate oral health  
Despite a strong recommendation to stop using smokeless tobacco the patient did not stop “dipping.” During the six-week trial the patient continued to dip in the same frequency and in the same area in the mouth, the only change in habit was using the gel 3x per day.

Periodontist: Pat Allen, DDS PhD, Dallas, TX

# Before and Afters (cont)

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Patient Stats: Female, Age 55, Overweight, No other medical issues known.

The photo on the left is 4 weeks after the 6 monthly sessions of SRP. The tissue of the patient had responded as much as it was going to from non-surgical perio therapy. The question was then asked: would the tissue further respond with a daily topical AO gel? The gel was applied 2x per day for three weeks and clearly you can see the tissue change.

Periodontist: Pat Allen DDS PhD, Dallas TX



Day 180,  
SRP x 6



Day 201, 3 weeks of  
Topical Gel

# Chlorhexidine?

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- Can we reduce bacteria completely?
- Recent research shows that chlorhexidine kills fibroblasts, and suggests that we may want to rethink it's use.

1. [Journal of Dentistry, June 2013, J. Ghabanchi, et. al., "Effects of three Commercial Mouth Rinses on the Cultured Fibroblasts:An in Vitro Study."](#)
2. [Toxicol. Appl. Pharmacoll, 2009, Faria, et. al., "Chlorhexidine induced apoptosis or necrosis in L929 fibroblasts: A role for endoplamic reticulum stress."](#)
3. [Int. J. Morphol, 2006, Salami, et. al., "A comparison of the effect of Chlorhexidine, tap water and normal saline on healing Wounds."](#)

The use of Essential Oils (Menthol, Thymol, etc) as an alternative to Chlorhexidine to reduce gingival inflammation shows NO significant difference. [Journal of Periodontal, Feb. 2011, V. Leeuwen "Essential Oils Compared to Chlorhexidine with Respect to Plaque and Parameters of Gingival Inflammation: A Systematic Review"](#).

# QUESTIONS/DISCUSSION?

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Thanks for listening