

Keywords: xylitol, oral candida, denture related stomatitis

Is Xylitol an Effective Anti Fungal Treatment for Oral Candida Infections?

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Abstract

It is well understood that xylitol is a nonfermentable sugar alcohol. It cannot be used as an energy source because it interferes with bacteria growth and reproduction. In terms of oral candidiasis, biofilms on an oral prosthesis, most commonly a denture, are a major predisposing factor to chronic oral candidiasis. The purpose of this study was to establish if xylitol could inhibit the growth of a candida infection with a target patient who has suffered from chronic candida-associated denture induced stomatitis. The ultimate goal was to test if xylitol could be an effective treatment for antifungal drug resistant oral candida infections for this individual and by doing so, improve his quality of life.

Xylitol is widely becoming a safe and effective option for the prevention of dental caries. Xylitol is naturally found in low concentrations in the fibers of many fruits and vegetables, and can be extracted from various berries, oats, and mushrooms, as well as fibrous material such as corn husks and sugar cane bagasse and birch. (Xylitol Canada, 2012). Chemically, xylitol is a five-carbon sugar alcohol that prevents the growth of bacteria and enhances alkalinity compared to sugar, which is a six-carbon sugar alcohol that promotes bacteria and fungi growth and is acid forming. (Ashley; Barbieri, 2005). The structure of xylitol contains a tridentate ligand, $(\text{H-C-OH})_3$ that can rearrange with polyvalent cations like Ca^{2+} . This interaction allows Ca^{2+} to be transported through the gut wall barrier and through saliva may remineralize enamel before dental caries form. (Remacle; Claude; Reusens; Brigitte, 2004). When bacteria enter the body, they adhere to the tissues using a variety of sugar complexes. The open nature of xylitol and its ability to form many different sugar-like structures appears to interfere with the ability of many bacteria to adhere. (Sellman, 2003).

Candidiasis is a fungal infection of any species from the genus candida. *Candida albicans* is the most common agent of candidiasis in humans. *C. albicans* is commensal and a constituent of the normal gut flora comprising microorganisms that live in the human mouth and gastrointestinal tract. *C. albicans* lives in 80% of the human population without causing harmful effects, although overgrowth of the fungus results in candidiasis. *Candida* yeasts are generally present in healthy humans, particularly on the skin, but their growth is normally limited by the human immune system, by competition of other microorganisms, such as bacteria occupying the same locations in the human body. (Mulley; Goroll, 2006).

Unlike bacteria, both fungi and humans are eukaryotes. Thus, fungal and human cells are similar at the biological level. This makes it more difficult to discover drugs that target fungi without affecting human cells. As a consequence, many antifungal drugs cause side effects. Some of these side effects can be life-threatening if the drugs are not used properly. (Russell, 2010).

Denture related stomatitis is a common condition where mild inflammation and redness of the oral mucous membrane occurs beneath a denture. In about 90% of cases, candida species are involved. (Manfredi; Polonelli; Aguirre-Urizar; Carrozzo; McCullough, 2012). This is normally a harmless component of the oral microbiota in many people. Denture-related stomatitis is the most common form of oral candidiasis (a yeast infection of the mouth). It is more common in elderly people, and in those who wear a complete upper denture. Denture-related stomatitis is more likely to develop when the denture is left constantly in the mouth, rather than removing it during sleep, and when the denture is not cleaned regularly. There is controversy as to whether this condition represents a true

infection by *C. albicans* or just a reaction to the various microorganisms present underneath a denture. It has been reported that often the surface of the denture shows positive culture for candida but biopsies of the mucosa rarely show hyphae invading epithelium. Similarly, microbiologic swabs of the involved mucosa show a much less heavy colonization than the surface of the denture. This has led some to conclude that the defining feature of a true infection is absent in denture-related stomatitis. (Bouquot; Neville; Damm; Allen, 2002).

Tooth decay, debris-covered dentures, or poor oral hygiene may contribute to seniors increased levels of plaque, causing oral infections like candidiasis. A 12-month English study of 111 frail but healthy seniors aged 60 and over were divided into three groups with 1) no gum, 2) chewing xylitol gum, and 3) chewing xylitol gum with an antimicrobial for 15 minutes, two pieces, two times per day. Researchers found that the groups chewing xylitol gum lowered their risk for developing candidiasis (fungal or yeast infection) and angular cheilitis. (Simons; Brailsford; Kidd, 2002).

Context

I am a Registered Dental Hygienist, a Certified Dental Assistant and a Certified Preventive Functions Dental Assistant. I have over 25 years of experience giving direct patient care. I volunteer at several free clinics and go on mission trips out of the country frequently. I absolutely love implementing dental disease prevention through education and treatment to the less fortunate.

My personal concern with the topic of xylitol used as an antifungal treatment stems from the compassion I have towards a friend's father who struggled with chronic candida-associated denture induced stomatitis. This elderly gentleman has tried the typical anti-fungal medications to no avail. His chronic oral condition led to discomfort, loss of taste, burning mouth ulcerations and bilateral angular cheilitis; all of which made it difficult for him to eat or wear his existing denture.

The significant goal of this project was to contribute an action research project for alternate OTC (over-the-counter) products "off label use" which would aid patients who suffer from chronic candida-associated denture induced stomatitis. This project was designed to offer insight into the possibility of using xylitol as an effective antifungal treatment for this condition. If the use of this product could help improve the quality of life for this individual, then this effort would have had a positive contribution to his overall quality of life. Another less important goal was to provide a case study from which further scientific research could be based.

Significance

The impact on oral health of this action research project was both focused and generalized. The focused impact was to improve the target patients overall oral health by alleviating his symptoms caused by chronic candida-associated denture induced stomatitis. The generalized impact was to open research possibilities of using xylitol products “off label” for alternate purposes and/or conditions not specified for its original use.

Study Design and Methodology

After conferring with the target patient’s son, who is also a dentist, we determined that the patient was a prime candidate for this case study. During this discussion, anticipated outcomes were discussed as well as possible risks and complications. The patient’s son was well versed on the benefits of xylitol use and was eager to try this product with his father. The patient was also eager to try anything that could possibly help with relief from his discomfort. The patient, nor his son, had any preconceived notions on this products benefit, which made this the ideal position to see if it helped, or not.

The patient was given an informed consent form, ethics and privacy statement. These were reviewed and signed by his son, who also serves as the patient’s legal guardian and dentist. Copies of these forms were also given to the assisted living home in which the target patient resides. I also obtained visitation privileges so that I could visit/examine the target patient without direct supervision of his son, or any dentist for that matter.

A product information sheet was provided to the assisted living facility so that the target patient’s CNAs (Certified Nursing Assistants) would understand the product use protocol. This was needed in case the target patient had difficulties placing the product in his denture himself and required the assistance of a CNA.

Outcome

Product Data

The patient was given two tubes of Xylitol Spry Infant Tooth Gel free of charge.

Product Use

The patient was instructed to use a nickel-sized amount of the Spry Infant Tooth Gel under his existing upper denture up to five times a day. The patient was allowed to use the product on his lower dentition as well. The patient was instructed to cease use after one tube was depleted.

Relief Experience

The patient began experiencing relief from chronic candida-associated denture induced stomatitis symptoms after only two weeks of xylitol gel use. Visual examination revealed reduced inflammation and redness of gingiva and palatal tissues. Patient was able to wear his denture more often and for longer periods of time than before xylitol treatment began.

Product Likeability

The patient's CNAs at the assisted living facility first began applying the product for the patient at the onset of the trial. However, after the patient began to have relief from symptoms, he began applying the product himself. He even requested a second tube after the first one was depleted.

Business Perspective

Exploring other applications for the use of xylitol in the use of treating fungal infections would benefit both the public consumer and the manufacturers of xylitol products. When more benefits of xylitol use are explored, product demand will increase leading to more sales/revenues earned from manufacturers. I can see more research and product development by xylitol manufacturers in promoting xylitol in other products not necessarily oral related (i.e. denture adhesives, denture cleaners, feminine hygiene products, athlete foot powder, body soaps, etc.) Xylitol educators would also benefit by having a new topic for discussion, which would draw in more attendance for lectures.

Reflective Learning

For me, this was the most difficult segment of the case study. The reflective learning style consists of reviewing new information, forming questions and then considering real-life applications of theory. This learning style was not practiced, or encouraged in my previous academic experiences. I admit I am not comfortable with this type of learning. I have a very direct and analytical/driver type personality and feel uneasy with thinking “outside of the box”. My father had a military background, so I am very accustomed to following orders or direction from others with little questions. With that said, I refocused on my thoughts since beginning my learning at O’Hehir University and reflected on what I have observed so far with my case study.

Subject Participation

The target patient was an elderly gentleman who had suffered a stroke almost 20 years ago. He had slight motor skill impairment on his right side and had difficulty forming sentences. An issue I encountered was establishing rapport and trust. After spending some time with this patient, I developed an understanding of his mannerisms and habits. I could see that the patient became agitated when he could not adequately converse his desires or demands. I modified how I delivered instructions so not to belittle him and patiently waited on his responses to questions.

Product Choice

I chose Xylitol Spry Infant Tooth Gel because of its safety. It contains no artificial ingredients, no gluten and is made from non-GMO products. It is not harmful if swallowed. This was important in case the patient was diabetic. Also, there have been no reported adverse, toxic or allergic reactions to the use of this product. It was also easy for the patient, who has limited dexterity, to manipulate and apply himself.

Study Length

I really did not have a specific time frame for the conclusion of this case study. The patient used an entire tube of the product after roughly three weeks. He was then without any xylitol products for roughly two weeks before he received and used another tube. In the future, I would set specific trial dates with specific time frames for evaluations and data collection. I also should have taken pre-treatment and post-treatment photos of the patient’s dentition, tissues and denture. I also would have taken a culture sample of the infected area to test if in fact the condition was a true candida infection.

Conclusion

This study suggests that xylitol could inhibit the growth of a candida infection with a target patient who has suffered from chronic candida-associated denture induced stomatitis. This particular target patient's symptoms are drastically reduced, leading to less discomfort, a healthier appetite and an improvement in his overall health. While conducting this action research study, I noted an additional, unexpected benefit. The patient also suffered from bilateral angular cheilitis at the onset of the study. Midway through the study, I instructed the patient to apply the Spry Infant Tooth Gel to the right commissure only. Within one week there was a visible improvement in the appearance of the treated commissure. I had always assumed that angular cheilitis was caused from a vitamin deficiency. These observations of improvement with the use of an antifungal treatment lead me to expand my research on oral fungal infections, their typical treatment regimens and their implications in relation to oral cancer precursors. Some doctors theorize that candida or other systemic fungal infections cause, or at the very least, contribute to the development of cancer. When you examine the link between fungus and cancer further, this makes sense. Not only does the immune system become overwhelmed and worn out from fighting the infection, but candida excrete toxins that further weaken the body's immune system. Milton White, MD believed that cancer is a "chronic, intracellular, infectious, biologically induced spore (fungus) transformation disease." He was able to find fungal spores in every sample of cancer tissue he studied. (White, 1996). In a Danish study last year, candida species infection appeared to be associated with increased cancer risk. The risk of mouth and throat cancers remained more than three-fold increased in the second and subsequent years of follow-up. It concluded that hospital presentation with candida infection is associated with increased short- and long-term cancer risk. (Nørgaard M, Thomsen RW, Farkas DK, Mogensen MF, Sørensen HT, 2013). Not only does xylitol show to be a benefit to treating oral candida infections, but also there are strong implications that they could potentially prevent oral cancer lesions from developing. This benefit is not limited to the oral cavity but also applies to the overall systemic health of our patients. When I began my action research journey I honestly believed I would just be evaluating if one patient benefited from the use of an OTC product used "off label" to treat a common condition. However, while exploring this topic via reflective learning I have delved into a mind-blowing influx of research information that is encouraging, and refreshing, to say the least. My eyes have been opened to new avenues to not only treating disease but also preventing it, which are less invasive and sensible.

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