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Research Article

AN IN-DEPTH STUDY ON THE ISOLATION, DIAGNOSIS, AND TREATMENT OF BACTERIA ASSOCIATED WITH DENTAL CARIES

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ABSTRACT

Tooth decay is the gradual breakdown of tooth components, resulting from the loss of hydroxyapatite crystals as part of aging. Mutans Streptococci is one of the species most associated with tooth decay. The samples were isolated and cultured following standard procedures, and the results showed that Streptococcus mutans was indeed the most isolated bacteria, accounting for 47 (85.5%) cases in people with tooth decay. Small soft blue colonies of S. mutans bacteria appeared due to their absence in several individuals which may be attributed to their small numbers. Lactobacilli were also isolated in 8 (14.55%) cases. Antibiotic sensitivity tests against S. mutans showed that this bacterium was sensitive to azithromycin antibiotic and resistant multi-antibiotic tetracycline, as well as amoxicillin, tobramycin, and ciprofloxacin along with chloramphenicol, ampicillin and lincomycin. The objective of this study is to isolate and identify bacteria that cause tooth decay, and determine which antibiotics effectively inhibit them.

KEYWORDS

Streptococcus mutans, Tooth decay, Bacteria diagnosis, Lactobacilli, Antibiotic sensitivity tests, Hydroxyapatite crystals.

INTRODUCTION

Tooth decay entails the gradual deterioration of tooth components due to the loss of hydroxyapatite crystals, a key component in dentin and enamel (Nisengand & Newman, 1994). One species predominantly associated with tooth decay is Mutans Streptococci (Tauzer et al., 2001). These bacteria reside in dental plaque and adhere to the tooth surface where they produce significant quantities of glucan or fructan. This production depends on their carbon source and is facilitated by enzymes located on the bacterial cell

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membrane. Glucan and fructan aid these bacteria in adhering to the tooth's surface and influence material accumulation within plaque. Moreover, they serve as energy reserves while also providing cell protection (Samaranayake, 2006).

Lactobacilli - acid-producing rod-shaped bacteria - represents another critical player in caries progression. Under normal conditions, this bacterium constitutes a minor proportion of oral flora. However, when oral acidity increases – typically following sugar digestion by fermentative processes undertaken by certain oral bacteria like Mutans Streptococci – the environment becomes ideal for Lactobacilli proliferation. These hardy acid producers then catalyze calcium and phosphate leaching from dentin and enamel leading to cavity formation (Winston et al., 1998).

To counter tooth decay and eliminate its causative bacteria, various chemical compounds, natural substances, and plant extracts have been employed including sodium fluoride and Chlorhexidine - commonly used anti-caries agents (Stookey & Beiswanger, 1995). Chlorhexidine serves as an oral rinse that reduces bacterial plaque and combats gum infections given its broad-spectrum activity against many bacteria and fungus types. It disrupts bacterial attachment to teeth while associating with oral surfaces from where it's slowly released into saliva (Samaranayak, 2006).

This study aims to isolate and identify the bacteria responsible for tooth decay and establish their susceptibility to various antibiotics.

MATERIALS AND METHODS

Sample Collection:

Saliva samples were collected from individuals with tooth decay in the early morning hours, ensuring that subjects had not consumed any food for at least an hour and had refrained from using toothpaste after their last meal. These samples were promptly transferred to the laboratory for analysis.

Bacterial Isolation and Identification:

We followed the procedures outlined by Hatemink et al., (1997) and Svanbeng & Krasse, (1990) for bacterial isolation. Serial dilutions were performed with saline solution on saliva, taking 1 ml from each of the second and third decimal dilutions. These were cultured twice on both Blood agar and McCongey agar plates via pour plate method, then incubated at a temperature of 37°C for 48 hours to isolate Lactobacilli bacteria.

From the same dilution, 0.1 ml was inoculated twice onto Mitis Salivarius agar plates using spread plate method and incubated anaerobically for 48 hours at 37°C to isolate Mutans Streptococci bacteria. The resultant colonies were selected from solid media and transferred to MRS broth (for Lactobacilli) and Tryptone Soy broth (for Mutans Streptococci). Chemical tests were subsequently performed on these purified isolates.

Susceptibility Test:

The disc diffusion test was employed in this study following the Kirby-Bauer method.

RESULTS

As shown in Figure 1, Streptococcus mutans was the most isolated bacterium, accounting for 47 (85.5%) of all isolates from individuals with tooth decay. Small soft blue colonies indicated S. mutans presence; however, these types of bacteria could be absent or found in small numbers in some people. Lactobacilli accounted for a smaller proportion with a total of 8 isolates (14.55%).

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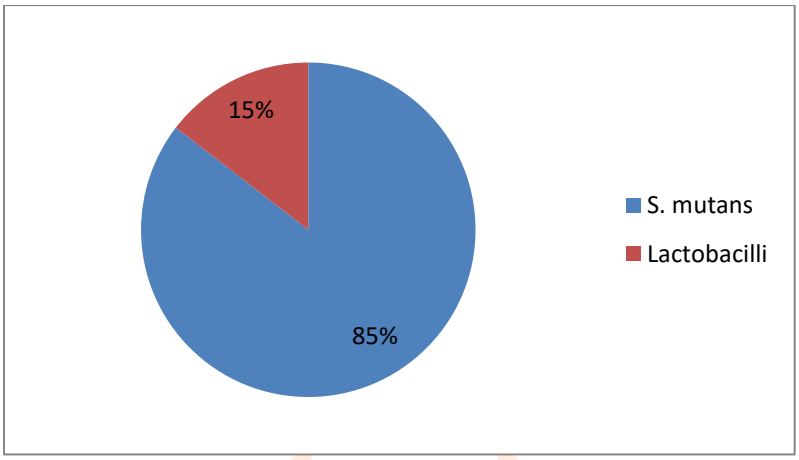

Figure 1: Predominantly Isolated Bacteria from Studied Cases

Antibiotic sensitivity tests against S. mutans revealed that this bacterium was sensitive to erythromycin and exhibited multi resistance to tetracycline, while it demonstrated varying responses to other antibiotics like amoxicillin, tobramycin, ciprofloxacin, chloramphenicol, ampicillin, and lincomycin.

Ideal growth conditions for the bacterial types of bio boosters utilized in this study were established during incubation. These conditions facilitated high primary numbers essential for the therapeutic and preventative medical use of bio boosters. This application is particularly relevant for gastrointestinal diseases and more recently oral health, despite limited references concerning gum diseases (Vivek & Bhavana, 2010).

Chlorhexidine exhibits antibacterial properties by attacking microbial cell walls. It has a broad-spectrum activity against Gram-positive bacteria, Gram-negative bacteria, aerobic organisms, anaerobic organisms, and fungi. Variants of this agent include an 18% alcohol-containing form - CHX-alcohol - which is widely used but impractical for many patients due to potential side effects such as bad breath, mouth dehydration, ulcers formation and redness. Some studies have even suggested a possible link with oral cancer.

Another variant is the alcohol-free type - CHX-alcohol-free - which although less potent may cause mild irritation, calcification disturbances and taste changes. One common symptom associated with its use involves tooth staining; a condition that may also affect artificial dentures and tongue repairs. Removing stains on cracked or cavity-ridden teeth can be quite challenging (Leyes Borrajo, 2002). Other side effects could include dry mouth sensation, appearance of white lines in the mouth or lips sores, swollen salivary glands beneath the jawline along with general oral irritation and unpleasant taste alteration (Van Steenberghe et al., 2001).

CONCLUSION

Sensitivity testing against S. mutans indicated sensitivity towards erythromycin and resistance towards tetracycline while exhibiting varied responses to other antibiotics such as amoxicillin, tobramycin, ciprofloxacin chloramphenicol , ampicillin and lincomycin.

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