FEATURE ARTICLE

ORAL HEALTH INTERVENTIONS USING CHLORHEXIDINE–EFFECTS ON THE PREVALENCE OF ORAL OPPORTUNISTIC PATHOGENS IN STROKE SURVIVORS: A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Objective

To evaluate the presence of oral opportunistic pathogens among stroke survivors, both before and after oral health care interventions.

Methods

A multicenter randomized clinical trial was conducted on hospitalized stroke survivors. Those in the control group were given standard care of oral hygiene (a manual toothbrush and toothpaste), whereas those in the test group were given intense care of oral hygiene (a powered toothbrush and 1% chlorhexidine oral gel). Oral clinical assessments were carried out, and microbiological samples were collected, using concentrated oral rinse samples at 3 time points: baseline, 3 months, and 6 months.

Results

The prevalence of oral yeast was significantly reduced in the test group at 6 months ($P < .05$), but no significant difference was observed over time. A significant reduction was observed in the prevalence of *Staphylococcus aureus* ($P < .01$) and aerobic and facultative gram-negative bacilli over time ($P < .05$), but there were no significant differences noted between groups at 6 months. *Candida albicans* and *Klebsiella pneumoniae* were the prominent pathogens determined throughout the trial. *Kluyvera* strains have also been isolated from this cohort.

Conclusion

Oral hygiene intervention using a powered tooth brush and 1% chlorhexidine oral gel was effective in reducing the prevalence of oral opportunistic pathogens.

INTRODUCTION

The oral microbiome is a complex and dynamic ecosystem.[1] A healthy oral microbiome is described as the multispecies of oral microbiome that live in equilibrium with each other and in commensalism with their host.[2,3] Alterations in

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the ecosystem due to changes in systemic health or the oral environment may lead to pathologic changes of the oral cavity and related systemic conditions.[4] Diseases such as a stroke have been shown to impact the oral environment as a consequence of a neurologic deficit (Schimmel et al. 2013).[5] The impairment of upper extremities and cognitive, as well as function of the oral structures increase the accumulation of dental plaque which subsequently leads to the development of plaque-associated diseases such as dental caries and periodontal diseases.[6,7] Dysphagia or swallowing difficulty that commonly occurs in stroke patients also contributes to a change in the oral environment. As a result of an imbalanced ecosystem, an environment for adhesion and colonization of pathogenic bacteria such as *Staphylococcus aureus, Pseudomonas aeruginosa*, and gram-negative bacilli is formed.[8,9] Studies also showed that *S aureus* and gram-negative bacilli were the dominant oral pathogens in patients under intensive care treatment and chronic care elderly patients.[10,11] These bacteria and yeast are among the most common oral opportunistic pathogens attributed to the development of infection among stroke patients, with aspiration pneumonia being most commonly reported.[12,13]

Patients with dysphagia were reported to have a high risk for aspiration pneumonia compared with those without dysphagia because of the high prevalence of oropharyngeal pathogens.[11] Nevertheless, a high risk of pneumonia was associated with both the symptomatic and asymptomatic types of aspiration.[14] In addition, it was noted that a large volume of aspiration may carry greater risks than a small volume of aspiration.[14] Apart from the type and volume of aspiration, the presence of oral opportunistic pathogens in the frail and immunocompromised patients was associated with the increased risk of aspiration pneumonia.[15] Studies have reported that interventions in oral hygiene are successful in reducing the incidence of aspiration pneumonia[16] and improving oral health and oral health–related quality of life.[17,18]

There are, however, still a limited number of studies on stroke patients with regard to oral hygiene and pathogens. Thus, this study aimed to evaluate the effectiveness of 2 oral hygiene interventions, standard care of oral hygiene (a manual toothbrush and commercial toothpaste) and intense care of oral hygiene (a powered toothbrush and 1% chlorhexidine [CHX] oral gel), on oral opportunistic pathogens among stroke survivors.

MATERIALS AND METHODS

Population Sampling

A total of 86 hospitalized stroke patients were recruited from five public hospitals in Malaysia. The hospitals were from the Klang Valley area: 2 from the state of Selangor and 2 from Kuala Lumpur (capital city of Malaysia), and 1 hospital was from the neighboring state Negeri Sembilan. The recruitment was conducted from June 2015 to February 2016, and the trial was completed in August 2016. The study was registered with the National Medical Research Registry of Malaysia [NMRR-13-1664-17247(IIR)]. Following ethical approval, permissions were obtained from the Medical Research and Ethics Committee and the directors of the respective hospitals.

The inclusion criterion in this study was medically stable and dentate stroke patients with a Modified Barthel Index (MBI) score less than 70 and under the management of rehabilitation physicians. Patients who were on antibiotics or antimicrobial agents were not recruited into the study. Patients who were cognizant to follow instructions at baseline and follow-up assessments were included in the trial. Patients who agreed to participate in the study were enrolled into this multicenter, parallel-arm, randomized clinical trial. Information sheets about the study were provided to the patients and a written informed consent was obtained before commencement of the study.

Data Collection

After baseline assessment and data collection, the participants were randomized into a control group and test group using "block randomization." Those in the control group were each given standard care of oral hygiene (a manual toothbrush and commercial toothpaste), whereas those in the test group were each given intense care of oral hygiene (a powered toothbrush and 1% CHX oral gel). All participants received oral hygiene instructions from an assigned dental assistant. The information on group allocations was kept anonymous, and the investigator performing the clinical assessment was blinded to this information.

Microbiological Sampling

Ten milliliters of sterile phosphate buffered saline solution (0.1 M, pH 7.2) was given to each patient for oral rinse for 60 seconds. The patients subsequently expelled the oral rinse into a sterile conical tube (Falcon, UK). The tube was transported on ice to the laboratory for the microbial culturing process. Throughout the study, the oral rinse samples were collected at 3 time points: baseline (before the intervention), 3 months, and 6 months after the interventions.

Microbiological Isolation

A volume of 100 µL of the samples was aseptically aliquoted onto 4 selective agar media: Sabouraud dextrose agar, mannitol salt agar, MacConkey agar, and CHROMagar plates (CHROMagarTM Candida [CA], CHROMagar, France). Sabouraud dextrose agar, mannitol salt agar, and CHROMagar plates were incubated at 37°C for 48 hours, while MacConkey agar plates were incubated at 37°C for 24 hours.