Speech Performance of Rugby Players when Using Different Types of Mouthguard

Research Protocol

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1. Introduction

Participation in sports carries a considerable risk for dental injuries (Sane, 1998). The prevalence and severity of sport related dental injuries varied, with an estimate between 0.2% and 33.5%, but is likely to be underreported (Cohenca et al., 2007). The risk of injuries increased with the age of the players, especially among those involved in long hours of training and compete professionally (Turbeville et al., 2003). Dental trauma often involves injuries to the tooth structure, periodontal tissue, oral mucosa and temporomandibular joints (Feliciano, 2006). The vulnerable site is upper jaw, particularly upper incisors (Glendor, 2008). These injuries often affect the appearance of the casualties, causing undue psychological stress (Berger, 2009). Furthermore restoring the injured teeth often requires extensive dental procedure with long-term follow-up at a high cost (Glendor, 2001). Thus, preventing the occurrence of dental trauma is crucial.

Mouthguards are typically composed of a thermoplastic copolymer, designed to fit over the occlusal surfaces of the maxillary teeth and extending near to the vestibular reflection (Patrick et al., 2005). Several authors demonstrated that wearing a mouthguard during sport can reduce the occurrence and severity of dental trauma (Yesil et al., 2009). Therefore, some sports authorities mandate the use of mouthguard (Quarrie et al., 2005).The purpose of using a mouthguard is to act as a buffer from trauma and provide a degree of protection for both the mouth's soft tissues (lips, gums, tongue) and hard tissues (teeth and alveolar bone) as well as protection from brain injuries (Knapik et al.,2007). The ability to protect the mouth is highly dependent on the ability of the mouthguard in shock absorption and impact dissipation (Craig et al., 2002).

There are basically three types of mouthguards that are available in the market. Type I (stock) are sold to the public and are used without any modification. Type II ('boil and bite')

mouthguards are the most commonly used mouthguards on the market and represent 90% of all mouthguards worn (Padilla et al., 1996). These are made of a thermoplastic material that is softened and then moulded to the dental arch by the user. Type III (custom-made) are made by a dentist using a mould of the patient's dental arches (Barbic et al., 2005).

However, the compliance of mouthguard use is often low. Among Malaysian university rugby players, those who discontinued using mouthguard complaint that general discomfort and speech disturbance are the main barriers to the compliance (Liew et al., 2014). The nuisance may be due to their use of poorly-fitted stock or boil-and-bite mouthguards (Liew et al., 2014). In comparison, custom-fitted mouthguards were considered the best choice because of its ability to maintaining oral moistness and adaptation, hence causing less interference with respiration and speech, while improving comfort and limiting nauseating effect (Duarte-Pereira et al., 2008). However, limited availability and higher prices hinder its widespread use (Guevara et al., 2001).

To date, the intensity and duration of oral discomfort caused by mouthguard remains unclear, with no published study to evaluate speech performance that employed acoustic analysis and sonography. Hence, the aim of this research is to evaluate the impact of wearing mouthguards on the speech performance of the athletes.

2. Problem Statement

Participation in sports expose players to increased risk of dental trauma. Thus, the purpose of wearing a mouthguard is to act as a buffer from trauma and provide a degree of protection for both the mouth's soft tissues (lips, gums, tongue) and hard tissues (teeth and alveolar bone). However, general discomfort and speech disturbance are the main barriers to the compliance of mouthguard use. The nuisance may be due to the use of poorly-fitted boil-and-bite mouthguards. In comparison, custom-fitted mouthguards were often considered the best choice because of its ability to maintaining oral moistness and adaptation, hence causing less interference with respiration and speech, while improving comfort and limiting nauseating effect. Nevertheless, the intensity and duration of oral discomfort caused by mouthguard remains unclear, with no published study to compare speech performance when using different types of mouthguard.

Therefore, this project is intended to compare the impact of different types of mouthguard on the speech performance of the athletes.

3. Research Questions

Is there any difference in speech performance when using 'boil and bite' and custom-fitted mouthguards?

4. Hypothesis

There is no difference in speech performance when using 'boil and bite' and custom-fitted mouthguards.

5. Aim and Objectives

Aim:

To compare the speech performance when using ‘boil and bite’ and custom-fitted mouthguards.

Objectives:

a) To provide ‘boil and bite’ and custom-fitted mouthguards to athletes.

b) To compare the immediate speech performance when using ‘boil and bite’ and custom-fitted mouthguards based on the auditive analysis and sonography of the mouthguard users.

6. Methodology

Selection criteria

The inclusion criteria are as follows:

(i) adult female aged 18 years old and older;

(ii) currently representing the nation and participating actively in rugby; and

(iii) native speakers of Malay (national language).

The exclusion criteria are as follows:

(i) did not play rugby within the last six months;

(ii) edentulism;

(iii) has used a mouthguard, orthodontic appliance or removable prosthodontics appliance within the last six months;

(iv) known history of allergy to polymers; and

(v) medical problems (ASA classification 3 and above).

Sample size

The sample size required is determined using G*Power software (available at: http://www.gpower.hhu.de/). The assumptions were an effect size of 0.25, 5% margin error, 80% power, within-subject measurements for the two types of mouthguard and control – not wearing any mouthguard. Correlation among measures was set at 0.5. This yielded a minimal sample size of 28. A drop-out rate of 10% was expected between first visit and fitting visit. Thus, the total sample size was adjusted to 32.

Interventions

Informed consent will be obtained before the commencement of the study. Interested participants must provide consent in written form. Simple questions will be asked to inquire about demographic details and the use of mouthguards and problems faced if not wearing one at the moment. Also, questions will be asked regarding existing speech impairment or disturbance.

Dental examination will be carried out to all the consented participants to identify edentulism and prosthesis in the mouth. Dental impression will be taken using alginate impression material and rigid perforated stainless steel trays. The impressions will be rinsed under running tap water before spraying with disinfectant. The impressions will be transported in sealed and labelled zip-lock bags.

The impressions will be casted within the same day using Type II dental stone. Fabrication of mouthguards will be carried out by technicians using Essix mouthguard sheets and vacuum machine, with the edges extend towards the vestibule and even thickness of 4mm. Sharp edges will be smoothened.

At the fitting session, each participant will be given a ‘boil and bite’ mouthguard and a custom-fitted mouthguard. For ‘boil and bite’ mouthguards, the participants will immerse the

acrylic sheet in a bowl of hot water and fit the softened sheet on their dental arches, following the manufacturer's instructions. The completed custom mouthguards will be fitted. Any complaint of sharp edges will be handled. The players will then be instructed on the care of the mouthguards.

Immediately after fitting, speech performance will be recorded digitally in standardized conditions in a soundproof room. The volunteers will be asked to pronounce 5 two-syllable words with different consonant: *paku, bola, dadu, tatu.* Four recordings will be done, for each of the following conditions: (i) not using mouthguard; (ii) using a 'boil and bite' mouthguard; and (iii) using a custom-fitted mouthguard. The recording samples will be digitized into a computer.

Data analysis

Demographic data will be summarized using descriptive statistics. Audio recordings will be digitized with Praat software. Mean voice onset time will be compared using repeated measure ANOVA with post hoc Tukey test. However, if normality assumption is violated, the non-parametric equivalent, Friedman's test and post hoc Wilcoxon signed-rank test will be used.

7. References:

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8. Flowchart of Methodology