

The Impact of Ergoprism Loupes and Through-The-Lens Loupes on Upper Body Muscle Activity in Dental Hygiene Students

Dr. Sachini Kodi from the Exercise Science department and I are collaborating on a study to examine the difference in muscle activity and strain among dental hygiene students who wear Through-The-Lens magnification loupes versus Ergoprism loupes. Our study also aims to determine if there is a relationship between perceived stress and muscle activity use and strain in dental hygiene students.

Introduction

Due to the nature of their profession, dental hygienists are known to exert their upper body muscles repeatedly. A typical work shift of a dental hygienist is eight hours long; during one shift, they usually see about eight to 16 patients. When a patient undergoes dental hygiene treatment, they lie on a dental chair, and the dental hygienist sits next to the patient on a dental operator chair. Due to the volume of the dental chair, chair armrests, and patient size, dental hygienists must lean forward to achieve good visibility of the patient's teeth. Moreover, during the observation/cleaning process, dental hygienists must keep their shoulders abducted with no arm support to rest their arms. Due to these reasons, dental hygienists' back muscles and shoulder abductors undergo fatigue over time, resulting in back and shoulder pain.

To get a magnified view, dental hygienists traditionally use Through-the-lens Loupes during appointments. However, these loupes require a head tilt of 20 degrees, requiring them to constantly flex their necks while examining a patient. Thus, their neck muscles undergo fatigue, resulting in neck pain by the end of the work day. Thus, Ergoprism Loupes were introduced with neutral posture in mind, requiring the eye to look parallel to the floor and the ears to be over the shoulders with zero declination in a forward head tilt. Due to this ergonomic design, dental hygienists can keep their necks in the anatomical neutral position while examining patients. Although Ergoprism Loupes have the capability of reducing neck muscle fatigue in contrast to Through-The-Lens Loupes, there is still a dearth of literature on the effects of the two types of Loupes on upper body muscle activity. Therefore, this study aims to investigate the impact of Ergoprism Loupes and Thru-The-Lens Loupes on upper body muscle activity in dental hygiene students.

Hypothesis

It is hypothesized that,

- there will be a significant difference in splenius capitis, deltoid, and upper trapezius muscle activity with the two types of loupes (Ergoprism Loupes and Through-The-Lens Loupes).
- there will be a significant difference in splenius capitis, deltoid, and upper trapezius muscle activity after one semester of using the two types of loupes.
- there will be a significant difference in participants' rate of perceived exertion (RPE) with the two types of loupes.
- there will be a significant correlation between the participants' personal stress levels and the activity of the aforementioned muscles.

Objectives

This study aims to investigate the impact of Ergoprism Loupes and Through-The-Lens Loupes on upper body muscle activity in dental hygiene students.

Specific aim 1: To assess whether there is a significant difference in splenius capitis, deltoid, and upper trapezius muscle activity with the one types of loupes (Ergoprism Loupes and Through-The-Lens Loupes).

Specific aim 2: To assess whether there is a significant difference in splenius capitis, deltoid, and upper trapezius muscle activity after two semesters of using the two types of loupes.

Specific aim 3: To assess whether there is a significant difference in participants' RPE with the two types of loupes.

Specific aim 4: To assess whether there is a significant correlation between the participants' personal stress levels and the activity of the aforementioned muscles.

Methods

For testing, the 16 dental hygiene students (eight with Through-the-Lens loupes and 8 with Ergoprism loupes) went to the Biomechanics Laboratory (WI 113) in the Swenson Building, where the study was conducted. They were asked to come to the lab for two days, one during Fall 2023 and another during Spring 2024.

Upon arrival on day one (in Fall 2023), the testing procedures were explained to the participants, and their questions were answered regarding the protocol. Then, they were asked to sign the consent form and fill out a physical activity readiness questionnaire+ (PARQ+) to assess any existing pathology. Participants' age, height, weight, gender, dominant arm, and the type of loupe they use will be recorded. In addition, the participants will be advised to fill out a *Modified Stress Questionnaire* to assess their current stress level and rate their current perceived exertion using the RPE scale. Before rating their current perceived exertion, a researcher described the RPE scale to the participant.

Then, electromyography (EMG) stickers were pasted on the participant's bilateral splenius capitis, deltoid, and upper trapezius muscles. The participants wore the loupe type they usually use (Ergoprism or Through-The-Lens Loupes). The participants sat on a portable dental operating chair and acquired the usual position as they would provide dental hygiene treatment to an actual patient. Once the participants gained the relevant position, their muscle activity was recorded as a baseline measurement, at 0 minutes. Then the participants were asked to simulate the usual dental hygiene treatment procedures that they would normally perform in a dental clinic. During this simulation, they were advised to maintain their body position as during an actual treatment procedure. The participants were advised to perform the simulation for 30 minutes, and their muscle activity was recorded at 15 and 30 minutes. At the end of 30 minutes, they were asked to rate their current perceived exertion using the RPE scale, which marks the end of testing day one.

This same procedure was repeated for day two in Spring 2024. Data is currently being collected and the project is intended to be completed by August 2024 with publication submissions to a biomechanics and dental hygiene journal.