An Evaluation of the Effectiveness of Refractive Loupes as an Intervention to Prevent Chronic Neck and Back Pain in Undergraduate Dental Students – a Longitudinal Study

Neha Raghava *, Tanay Kulkarni , Mary Beth Cantiveros

Posted Date: 11 October 2024

doi: 10.20944/preprints202410.0904.v1

Keywords: ergonomic loupes; refractives; clinical ergonomics; dentistry; loupes

Article

An Evaluation of the Effectiveness of Refractive Loupes as an Intervention to Prevent Chronic Neck and Back Pain in Undergraduate Dental Students—A Longitudinal Study

Neha Raghava *, Tanay Kulkarni and Mary Beth Cantiveros

* Correspondence: neha@bryant.dental

Abstract: Chronic neck and back pain is prevalent among dental professionals, stemming from the static and often awkward positions required during clinical practice. This longitudinal study investigates the effectiveness of Refractive loupes, an ergonomic intervention, in mitigating such musculoskeletal issues among undergraduate dental students. Despite being advocated for posture improvement, traditional loupes may exacerbate neck pain due to prolonged static neck positions. However, the impact of ergonomic loupes, designed to maintain neutral neck positions, remains unexplored. This study enrolled undergraduate dental students from the UK and Australia, provided them with Refractive loupes, and tracked their neck and back pain scores over two years. Participants completed pre- and post-intervention questionnaires assessing pain levels, posture, and loupe use history. Results indicate a significant reduction in pain incidence (15.5%) post-refractive use, with 30.6% of participants reporting pain at the study's end compared to 46.1% at the beginning of the study. Notably, 92.3% reported improved posture ratings despite 39.1% experiencing increased pain, suggesting additional factors contributing to pain development beyond posture alone. Further analysis reveals that later adoption of Refractive loupes correlates with increased pain, suggesting a potential preventive benefit if initiated earlier in dental education. Additionally, a comparison of traditional loupe users with their non-loupe-using counterparts indicates more significant pain reduction among the loupe-using cohort post-refractive use, highlighting the need for more extensive studies in this area. In conclusion, Refractive loupes effectively reduce musculoskeletal pain among undergraduate dental students. Nevertheless, challenges persist, warranting continued research into optimal intervention timing and the role of the loupe type used in pain mitigation.

Keywords: ergonomic loupes; refractives; clinical ergonomics; dentistry; loupes

---

SIGNATURE PAGE

The undersigned confirm that the following protocol has been agreed and accepted and that the Chief Investigator agrees to conduct the study in compliance with the approved protocol and will adhere to the principles outlined in the Declaration of Helsinki, the Sponsor's SOPs, and other regulatory requirement.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the investigation without the prior written consent of the Sponsor

I also confirm that I will make the findings of the study publically available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the study will be given; and that any discrepancies from the study as planned in this protocol will be explained.

 doi:10.20944/preprints202410.0904.v1

KEY STUDY CONTACTS

Chief Investigator	Dr Neha Raghava neha@bryant.dental +44 7500 058634
Sponsor	Dr Thomas Hayes-Powell thomas@bryant.dental +44 7930 116570

STUDY SUMMARY

Study Title	An Evaluation of the effectiveness of Refractive loupes as an intervention to prevent chronic neck and back pain in undergraduate dental students - a longitudinal study.
Study Design	A longitudinal study
Study Participants	Participants are UK students who purchase Refractives - they are offered the opportunity to enrol in our study. They are given surveys to complete pre and post-ergonomic loupe use, which asks them to rate their posture and neck and back pain before and after refractive loupe use.
Planned Study Period	2 Years
Research Question/Aim(s)	The primary aim of this study is to assess the effectiveness of Refractive loupes in reducing musculoskeletal pain, particularly in the neck and back, among undergraduate dental students. Specifically, this study aims to: 1. Evaluate the prevalence and severity of musculoskeletal pain among dental students prior to using Refractive loupes. 2. Determine the changes in musculoskeletal pain experienced by dental students after using Refractive loupes over a longitudinal period. 3. Investigate the impact of Refractive loupes on posture and ergonomic factors among dental students.

STUDY PROTOCOL

An Evaluation of the effectiveness of Refractive loupes as an intervention to prevent chronic neck and back pain in undergraduate dental students - a longitudinal study.

1. BACKGROUND

Chronic neck and back pain are prevalent among dental professionals, stemming from the static and often awkward positions required during clinical practice. This longitudinal study will investigate the effectiveness of Refractive loupes, an ergonomic intervention, in mitigating such musculoskeletal issues among undergraduate dental students. Despite being advocated for posture improvement, traditional loupes may exacerbate neck pain due to prolonged static neck positions.

 doi:10.20944/preprints202410.0904.v1

However, the impact of ergonomic loupes, designed to maintain neutral neck positions, remains unexplored.

2. RATIONALE

Chronic back and neck pain is one of the most commonly reported occupation-related health hazards experienced by dentists across the globe1. This is most closely related to the static2 and often contorted positions that dentists adopt to obtain direct vision while working. This musculoskeletal pain often begins at dental school3,4 with a systematic literature review suggesting that the prevalence of this pain in graduated dentists varies between 64% and 93%, with the most commonly cited regions of pain being back (36.3–60.1%) and neck (19.8–85%)5, when compared with, compared with 79% of dental students prior to graduation6 with worsening proportions of students complaining of pain as the dental school year of participants increased.

Traditional loupes have long been promoted as a way to improve spinal position and prevent chronic back pain; however, chronic neck pain is the second most reported musculoskeletal pain by dentists and dental students. Hodačová et al. found that the statistically significant increase in pain was in neck pain, not back pain, as dental students progressed from 1st to 5th year 7. Traditional loupes do not propose an ergonomic solution for the neck, and traditional loupe use increases the time users spend with their necks in a static position- a key contributor to the development of chronic pain. Although the relationship between traditional loupe use and neck pain has not been explored extensively, Sivak-Callcott, Jennifer. A et al. showed that traditional loupes did not prevent neck pain but were associated with an increased risk of neck pain in the oculoplastic surgeons they surveyed8. This finding was supported by the more extensive study by Wu et al.9, also in oculoplastic surgeons, in which 11% of their participants stated that neck and cervical spinal issues were associated with loupe use.

To our knowledge, no study has shown the effects of using ergonomic loupes, here defined as loupes that use prisms or deflective mechanisms to keep the neck in a neutral position during work. Moreover, none of the studies we encountered during our literature review included any interventional element and were typically observational. Our study was designed to study the effect of ergonomic loupes in a population of dental students across the UK and Australia who had been provided with ergonomic loupes to compare their neck and back pain scores at the end of their studies to the values reported in the literature in students who used traditional loupes or no loupes.

3. RESEARCH QUESTION/AIM(S)

The primary objective of this study is to assess the effectiveness of Refractive loupes in reducing musculoskeletal pain, particularly in the neck and back, among undergraduate dental students.

3.1. Objectives

Specifically, this study aims to:

1. Evaluate the prevalence and severity of musculoskeletal pain among dental students prior to using Refractive loupes.
2. Determine the changes in musculoskeletal pain experienced by dental students after using Refractive loupes over a longitudinal period.
3. Investigate the impact of Refractive loupes on posture and ergonomic factors among dental students.

3.2. Outcome

This study aims to contribute to the existing literature on musculoskeletal health among dental professionals by evaluating the effectiveness of Refractive loupes as an ergonomic intervention. By assessing changes in musculoskeletal pain and posture over time, we will seek to provide valuable insights into the potential benefits of using ergonomic loupes in dental education and practice.

 doi:10.20944/preprints202410.0904.v1

4. STUDY DESIGN and METHODS of DATA COLLECTION AND DATA ANALYIS

4.1. Participants

Participants are UK students who purchase Refractives - they are offered the opportunity to enrol in our study. They are given surveys to complete pre and post-ergonomic loupe use, which asks them to rate their posture and neck and back pain before and after refractive loupe use.

4.2. Intervention

Participants who have purchased Refractive loupes as an ergonomic intervention will be enrolled in the study. These loupes will be designed to maintain a neutral neck position during dental procedures, potentially reducing the strain on the neck and back.

4.3. Data Collection

Musculoskeletal pain and posture data will be collected through self-reported questionnaires administered at baseline and regular intervals throughout the study period. Study participants will be asked to report the presence, location, and severity of any musculoskeletal pain experienced, as well as their posture during dental procedures.

4.4. Data Analysis

Quantitative analysis will be performed to compare the prevalence and severity of musculoskeletal pain before and after the intervention. Descriptive statistics, such as means and percentages, will be used to summarise the data.

5. SAMPLE AND RECRUITMENT

5.1. Eligibility Criteria

All undergraduate dental students who may have or not have traditional loupes will be enrolled in the study. Participants who purchased Refractive loupes will be recruited and will complete a baseline questionnaire assessing their posture and musculoskeletal health prior to using Refractive loupes.

5.1.1. Inclusion Criteria

1. Undergraduate dental students currently enrolled in accredited dental programs in the United Kingdom.
2. Students who have or have not previously used traditional loupes during clinical practice.
3. Students who have purchased or are willing to purchase Refractive loupes (2.9x, 3.8x, or 5.7x) for use during clinical practice.
4. Students who have provided informed consent and are willing to complete baseline and follow-up questionnaires regarding musculoskeletal health and posture.
5. Students who are in good physical health and able to perform dental procedures without significant limitations.

5.2. Sampling

The sampling frame for this study comprises undergraduate dental students enrolled in accredited dental programs in the United Kingdom who purchased Refractive loupes. Participants will be recruited from various dental schools across the UK.

5.2.1. Size of Sample

 doi:10.20944/preprints202410.0904.v1

The sample size will be determined based on the number of students willing to participate but an ideal sample of at least 200 is targeted to ensure adequate power to detect meaningful differences in musculoskeletal pain and posture outcomes before and after the use of Refractive loupes.

5.2.2. Sampling Technique

The sampling technique employed will be convenience sampling, whereby participants who purchase Refractive loupes will be offered the opportunity to enrol in the study. Convenience sampling is chosen due to the practicality and feasibility of recruiting participants from within the accessible population of undergraduate dental students purchasing Refractive loupes.

5.3. Recruitment

Participants are UK students who purchase Refractives - they are offered the opportunity to enrol in our study. They are given surveys to complete pre and post-ergonomic loupe use, which asks them to rate their posture and neck and back pain before and after refractive loupe use.

5.3.2. Consent

Informed Consent Form

Introduction:

This study aims to investigate the effectiveness of Refractive loupes in reducing musculoskeletal pain among undergraduate dental students in the United Kingdom. Before deciding whether to participate, you have to be informed of the purpose, procedures, risks, and benefits of the study. Please take the time to read this document carefully, and feel free to raise any concerns before making your decision.

Study Purpose:

The purpose of this study is to evaluate the use of Refractive loupes in effectively reducing musculoskeletal pain, particularly in the neck and back areas, among undergraduate dental students. By participating in this study, you will contribute to the advancement of knowledge in the field of clinical ergonomics and musculoskeletal health.

Study Procedures:

If you agree to participate, you will be asked to complete two surveys assessing your posture, neck pain, and back pain before and after using Refractive loupes. These surveys will be administered electronically or on paper, depending on your preference. The surveys will ask you to rate the severity of your musculoskeletal pain and provide self-assessments of your posture at both points.

Risks and Benefits:

There are minimal potential risks associated with participating in this study. You may experience temporary discomfort in integrating Refractive loupes in your practice if you're accustomed to traditional ones or have never used loupes. However, the potential benefits of participating include contributing to the ergonomic interventions in dentistry and potentially experiencing diminished musculoskeletal pain through the use of Refractive loupes.

Confidentiality:

Your privacy and confidentiality will be protected throughout the study. All data collected will be kept confidential and stored securely following data protection regulations. Your personal information will not be shared outside of the research team without your explicit consent.

Voluntary Participation:

Participation in this study is voluntary, and you have the right to withdraw at any time without consequence. Your decision to participate or decline participation will not affect your academic standing or dental equipment purchases.

Contact Information:

If you have any questions or concerns about the study or a research-related concern, please feel free to contact the chief investigator, Dr Neha Raghava, at neha@bryant.dental.

Consent Statement:

 doi:10.20944/preprints202410.0904.v1

I have read the information provided above, and I understand the purpose, procedures, risks, and benefits of the study. I voluntarily consent to participate in this study and agree to complete the required surveys enclosed in this form. I understand that I may withdraw from the study at any time without consequence.

Participant's Signature: _____ Date: _____

Printed Name: _____

6. ETHICAL AND REGULATORY CONSIDERATIONS

Informed consent will be obtained from all participants before they participate in the study. Participants will be informed about the purpose, procedures, risks and benefits of the study, the voluntary nature of their participation, and their right to withdraw from the study at any time without consequences.

6.1. Data Protection and Patient Confidentiality

To protect the confidentiality of participant information, all completed questionnaires administered electronically, will be stored securely in password-protected databases accessible only to authorised members of the research team. Participant identifiers will be anonymised, and data will be aggregated for analysis to ensure confidentiality.

REFERENCES

1. SL; MELR. Musculoskeletal symptoms in New South Wales dentists [Internet]. U.S. National Library of Medicine; [cited 2024 Feb 1]. Available from: https://pubmed.ncbi.nlm.nih.gov/9316311/
2. U; RBB. Cervical pain and discomfort among dentists. epidemiological, clinical and therapeutic aspects. Part 1. A survey of pain and discomfort [Internet]. U.S. National Library of Medicine; [cited 2024 Feb 1]. Available from: https://pubmed.ncbi.nlm.nih.gov/2142828/
3. Felemban RA; Sofi RA; Alhebshi SA; Alharbi SG; Farsi NJ; Abduljabbar FH; Farsi JMA; Prevalence and predictors of musculoskeletal pain among undergraduate students at a dental school in Saudi Arabia [Internet]. U.S. National Library of Medicine; [cited 2024 Feb 1]. Available from: https://pubmed.ncbi.nlm.nih.gov/33633467/
4. O; RDBK. Reports of body pain in a dental student population [Internet]. U.S. National Library of Medicine; [cited 2024 Feb 1]. Available from: https://pubmed.ncbi.nlm.nih.gov/15693502/
5. Vijay S, Ide M. Musculoskeletal neck and back pain in undergraduate dental students at a UK dental school - a cross-sectional study [Internet]. Nature Publishing Group; 2016 [cited 2024 Feb 1]. Available from: https://www.nature.com/articles/sj.bdj.2016.642
6. DR; HMD. A systematic review of musculoskeletal disorders among Dental professionals [Internet]. U.S. National Library of Medicine; [cited 2024 Feb 1]. Available from: https://pubmed.ncbi.nlm.nih.gov/19659711/
7. Hodačová L; Pilbauerová N; Čermáková E; Machač S; Schmidt J; Hodač J; Kapitán M; The prevalence and development of neck and lower back pain and associated factors in dentistry students-a long-term prospective study [Internet]. U.S. National Library of Medicine; [cited 2024 Feb 1]. Available from: https://pubmed.ncbi.nlm.nih.gov/35886392/
8. Sivak-Callcott J, Diaz S, Ducatman A, Rosen C, Nimbarte A, Sedgeman J. A Survey Study of Occupational Pain and Injury in Ophthalmic Plastic Surgeons. [Internet]. Available from: https://pubmed.ncbi.nlm.nih.gov/20859236/
9. AY; WC. Surgical loupe usage among oculoplastic surgeons in North America [Internet]. U.S. National Library of Medicine; [cited 2024 Feb 1]. Available from: https://pubmed.ncbi.nlm.nih.gov/29631825/