# Impact of a seated-standing protocol on postures and pain among undergraduate dental hygiene students: A pilot study

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## Abstract

**Purpose:** Although repetitive movements may lead to musculoskeletal pain, static and sedentary postures may be primary contributors to musculoskeletal disorders. The purpose of this pilot study was to determine whether an alternating seated-standing protocol would improve postures, decrease ergonomic risks, and reduce perceived pain scores among dental hygiene students.

**Methods**: Thirty undergraduate dental hygiene students enrolled during the summer term were recruited to participate in the randomized control design pilot study. Participants were randomly assigned to the training (n=15) and control (n=15) groups. The training group alternated between sitting and standing every 30 minutes while providing dental hygiene care. The Modified-Dental Operator Posture Assessment Instrument (M-DOPAI) was used to evaluate ergonomic scores, the Rapid Upper Limb Assessment (RULA) was used to evaluate ergonomic risk, and the Modified-Standardized Nordic Musculoskeletal Questionnaire (M-SNMQ) was used to assess self-reported pain. Photographs were captured and levels of perceived pain were assessed at baseline, week-4, and week-8. Three raters independently evaluated the photographs using the M-DOPAI and RULA. Participants completed a survey about their experiences in the study at the end of week-8. Descriptive statistics and repeated measures ANOVAs were used to analyze the quantitative data; thematic analysis was used to analyze the qualitative data.

**Results**: Although all participants perceived a reduction of pain over the duration of the eight-week study ($p<.05$), the training group demonstrated no significant differences in ergonomic scores, ergonomic risks, or pain scores at the three time points ($p>.05$). Qualitatively, participants in the training group perceived that the seated-standing protocol clinically improved their postures and reduced their pain.

**Conclusion:** The results suggest there were minimal impacts of the alternating seated standing protocol on ergonomic scores, ergonomic risks, or perceived pain. More research is needed to determine whether there are objective benefits to an alternating seated-standing protocol.

**Keywords**: ergonomics, musculoskeletal disorders, standing postures, ergonomic risks, dental hygiene students

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## Introduction

A high prevalence of work-related musculoskeletal disorders (WMSDs) exists in the dental and dental hygiene professions.[1-6] Musculoskeletal pain among clinicians can lead to musculoskeletal injury over time, which can lead to musculoskeletal disorders that limit the ability to practice clinically. Many of the postural habits and symptoms of pain experiences by dental and dental hygiene professionals begin during their entry-level education.[3,7] Although repetitive movements may lead to musculoskeletal pain, static and sedentary postures may be a major contributor to musculoskeletal disorders.[8]

Prolonged seated postures have been associated with musculoskeletal and systemic health hazards.[9-11] In a systematic review conducted across multiple disciplines, Szczygiel et al. found seated postures involving incorrect postures of the head and pelvis contributed to cervical and lumbar spine disorders and diminished respiratory function.[9] In the general population, increased times in seated positions have been positively correlated with increased risks for cardiovascular disease, obesity, diabetes, and total mortality.[10,12] No differences in the amount of sedentary

behaviors were found between middle-aged women who engaged in sufficient (over 30 minutes) versus insufficient or moderate-vigorous physical activity.[11]

For dental and dental hygiene professions, recommended methods to prevent musculoskeletal disorders included using acceptable postures, proper lighting, switching between long and short appointments, and alternating between seated and standing postures.[13] Multiple general workplace interventions have been tested to decrease the amount of seated time at work, such as physical workplace changes, counseling, changes in break schedules and computer prompts. However, a systematic review revealed limited evidence on theoretical or proven strategies to reduce the amount of sitting in the long term, for the general population.[8] Additionally, limited evidence exists on the effect of alternating between seated and standing postures, specifically with an additional focus on the improvement in correct postures, reducing ergonomic risks, and reducing musculoskeletal pain. The purpose of this pilot study was to determine whether an alternating seated-standing protocol would improve postures, decrease ergonomic risks, and reduce perceived pain scores among undergraduate dental hygiene students.

## Methods

Expedited approval was granted by The Ohio State University Institutional Review Board (2019B0182) for this randomized control design pilot study. The study had four aims. Aims one and two were to determine whether an alternating seated-standing protocol would improve ergonomic scores and decrease ergonomic risk. The third aim was to determine whether alternating seated-standing protocol would decrease perceived pain scores, and the fourth aim was to evaluate participants' adherence to the protocol and study their attitudes regarding the seated-standing regimen. A convenience sample of 30 students enrolled in the dental hygiene program at The Ohio State University during the summer term 2019 were invited via e-mail to participate. After providing the potential participants with the research study details and an opportunity to ask questions, participants provided written informed consent.

### *Instruments*

The Modified-Dental Operator Posture Assessment Instrument (M-DOPAI) and the Rapid Upper Limb Assessment (RULA) were used to evaluate the student participant postures. The M-DOPAI has been used for the assessment of the postures of dental professionals.[14-16] The twelve components were patterned after Branson et al's Posture Assessment Instrument (PAI),[17] which consisted of ten components, and Maillet et al's Posture Assessment Criteria (PAC),[18] which includes two additional components involving the upper arms. The posture scores ranged from a low of 12 (ideal postures) to high of 32 (harmful).

The RULA has been widely used for ergonomic risk assessments.[19] The RULA uses diagrams and descriptions to evaluate risk factors for musculoskeletal disorders and provides an ergonomic risk score. The body is divided into two sections: 1) Upper arm, lower arm, and wrist and 2) Neck, trunk, and legs. The wrist/arm score is a combination of position, muscle, and force/load scores are used to calculate, which can range from 1 (low risk) to 9 (high risk). The neck, trunk, and leg score is a combination of position, muscle, and force/load scores, which can range from 1 (low risk) to 9 (high risk). The final scores are generated using the wrist & arm score and leg score, which has the following range of scores: 1-2=acceptable, 3-4=further investigation and change may be needed, 5-6= further investigation and change needed soon, and 7+= immediateinvestigation and change needed.

The Modified-Standardized Nordic Musculoskeletal Questionnaire (M-SNMQ) has been widely used as a validated instrument to assess musculoskeletal pain.[20] Pain in nine regions (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, ankles/feet) is evaluated using a dichotomous scale (yes or no). If pain in a specific section is reported, a new series of questions appears. To generate a pain score, all yes responses received a score of 1. Since the scores for knees and ankles/feet were excluded from the pain score, overall pain scores could range from 0-7.

To evaluate participants' posture, digital photographs were captured by calibrated members of the research team using a 10.5-inch iPad Pro (Apple; Cupertino, CA, USA). Two images (front and profile) were randomly captured in the middle of a patient care appointment of each participant during each timepoint of the study. Front view allowed for the evaluation of the trunk (front to back), head and neck (front to back), elbows (level), shoulder (level), and wrists (flexion or extension) and the profile view allowed for the evaluation of the hips, trunk (front to back), head and neck (front to back), upper arms (in rotation to torso), shoulder (relaxed/slumped), and wrists (flexion or extension). Sample images are shown in Figure 1.

### *Procedure*

All participants had received one hour of didactic instruction in general ergonomics principles in a prior preclinical course held in autumn 2018 and an additional 30 minutes of didactic instruction in standing ergonomics at the start of the summer 2019 term. The standing ergonomics instruction included principles of proper positioning

**Figure 1. Sample photographs of participant postures**


when working on the maxillary arch and when working on the mandibular arch, along with a review of operators photographed in a standing position.

The principal investigator (PI) assigned the 30 participants into a control group and training group using the random assignment feature in SPSS Version 26 (IBM; Armonk, NY, USA). The training group was instructed to follow the seated-standing ergonomics protocol, which was to switch from a seated to standing position every thirty minutes during each assigned three-hour clinical appointment. Figure 2 provides a sample outline on how to implement the seated-standing protocol. Participants were not required to strictly adhere to the sample protocol due to variations in the patient needs/conditions and each individual operator's habits in the implementation of dental hygiene care. The control group maintained normal seated positioning throughout each of the assigned three-hour clinical appointment sessions. E-mail reminders were sent to participants in the training group to

**Figure 2. Sample alternating seated-standing protocol (alternating positions approximately every 30 minutes)**

| | |
|---|---|
| Standing | Medical history review, vital signs, dental history review, extraoral and intraoral examinations |
| Seated | Clinical assessments: restorative charting, periodontal probing (maxillary arch) |
| Standing | Clinical assessments: periodontal probing (mandibular arch); risk assessments, dental and dental hygiene faculty check-ins |
| Seated | Plaque score and Oral hygiene instructions, ultrasonic instrumentation (maxillary arch) |
| Standing | Ultrasonic instrumentation (mandibular arch) |
| Seated | Hand instrumentation (maxillary arch) |
| Standing | Hand instrumentation (mandibular arch) |
| Seated | Coronal polishing |

adhere to the alternating seated-standing protocol at the start of each week.

Data collection took place over an 8-week period during the 2019 summer term. Demographic information (age, weight, and height) was collected at the beginning of the study (baseline). At weeks 0, 4, and 8, calibrated members of the research team captured images of all participants (front and profile) and participants reported their perceived pain levels using the (M-SNMQ) via an online survey platform (Qualtrics; Provo, UT, USA). At the conclusion of the study (week 8), all participants were asked to complete an evaluation survey with one open-ended question to provide general comments about the study. Participants in the training group were asked six additional closed-ended questions about their experiences with the seated-standing protocol; items included adherence to the protocol in the first four weeks, adherence to the protocol in the final 4 weeks, three attitudinal items regarding the protocol and one item regarding the likelihood of continuing the protocol in the future.

After the photographs were captured, three raters (two dental hygiene faculty members and one dental hygiene student) independently evaluated the photographs using the M-DOPAI and RULA instruments. The raters received a 30-min calibration session involving a discussion of ergonomic principles, recognition of compromised positions, and practice application of posture evaluations. The PI deemed consensus with scores with the agreement of at least 2 out of the 3 raters. The inter-rater reliability with the M-DOPAI was measured at Cronbach's alpha =.860 and intraclass correlation of .860

(95% CI=[.842-.876]). The inter-rater reliability with the RULA was measured at Cronbach's alpha =.702 and intraclass correlation of .8702 (95% CI=[.650-.747]).

### *Data analysis*

Data were analyzed using SPSS Version 26 (IBM; Armonk, NY, USA). Descriptive statistics and repeated measures ANOVAs were used to evaluate whether differences existed inergonomic scores, ergonomic risk, and perceived pain among participants between the control and training groups. Descriptive statistics were also used to analyze the attitudinal questions and thematic analysis was used to analyze the general comments.

## Results

A total of 30 participants were recruited and completed the study. There were no significant differences between the control and training groups in terms of age in years (*M*=21.3, sd=.89, p=.533), weight in pounds (*M*=141.7, sd=23.09, *p*=.911), and height in inches(*M*=65.9, sd=3.34, *p*=.826). Demographics are shown in Table I.

**Table I. Demographic characteristics (n=28)***

| Characteristics | Group (n) | Mean (sd) | 95% CI | | F | Sig** |
|---|---|---|---|---|---|---|
| | | | LB | UB | | |
| Age | Control (n=14) | 21.1 (.86) | 20.6 | 21.6 | .399 | .533 |
| | Training (n=14) | 21.4 (.93) | 20.8 | 21.9 | | |
| | Total (n=28) | 21.3 (.89) | 20.9 | 21.6 | | |
| Weight | Control (n=14) | 142.2 (21.30) | 129.9 | 154.5 | .013 | .911 |
| | Training (n=14) | 141.2 (25.55) | 126.5 | 156.0 | | |
| | Total (n=28) | 141.7 (23.09) | 132.8 | 150.7 | | |
| Height | Control (n=14) | 66.0 (3.26) | 64.1 | 67.9 | .049 | .826 |
| | Training (n=14) | 65.7 (3.54) | 63.7 | 67.8 | | |
| | Total (n=28) | 65.9 (3.34) | 64.6 | 67.2 | | |

* demographic characteristics are reported from 28 of the total 30 participants

** *p*-values < .05

For the first aim, repeated measures ANOVA was used to evaluate for significant differences in ergonomic scores, using the M-DOPAI, based on time and group (Table II). No interaction effects were found with time x group (*F*(2)=.557, *p*=.459). No significant differences were found with the main effect for time (*F*(2)=1.062, *p*=.54) or group (*F*(1)=.557,*p*=.459). For the second aim, repeated measures ANOVA was used to evaluate for significant differences in ergonomic risk scores, using the RULA, based on time and group (Table II). Nointeraction effects were found with time x group (*F*(2)=1.218, *p*=.304). No significant differences were found with the main effect for time (*F*(2)=.165, p=.848) or group (*F*(1)=.029,*p*=.866).

For the third aim, repeated measures ANOVA was used to evaluate for significant differences in perceived pain based on time and group (Table II). A significant difference with the main effect of time was found (*F*(2)=3.030, *p*=.050). Post-hoc analysis using Least Significant Difference (LSD) revealed significant decrease in perceived pain scores from week 1 (*M*=2.703, sd=.266) to week-4 (M=1.905, sd=2.88, *p*=.047) and from week-1 (*M*=2.703, sd=.266) to week-8 (*M*=1.869, sd=.276, *p*=.035).No interaction effects were found with time x group (*F*(2)=.979, *p*=.326) and no significant differences were found with the main effect for group ((*F*(1)=.979, *p*=.326).

For the fourth aim, 12 of the 15 participants in the training group completed the post-study survey, for an 80% response rate (Table III). Half of the training group participants reported compliance to the alternating standing/seated protocol over >50% of the time during weeks 1-4 and weeks 5-8. Most (64%, n=8) believed thatthe alternating standing/seated protocol resulted in improved postures in addition to a reduction of their perceived pain. However, more participants believed that while the alternating standing/seated protocol reduced their perceived pain (84%, n=10), it did not improve their postures (75%, n=9). Most (67%, n=8) reported the likelihood of using standing postures in the future when providing dental hygiene care.

General comments regarding the study protocols were elicited from a majority of participants (83%, n=25); the themes are shown in Table IV. Regarding the challenges to the alternating standing/seated protocol, over half of the training group (n=7) reported difficulty in adopting behavioral changes (remembering to alternate between sitting and standing) and the physical limitations (height of the patient chair, magnification loupes) while adopting the protocol in the student clinics.

## Discussion

The purpose of this pilot study was to determine whether an alternating seated-standing protocol would improve ergonomic scores, reduce ergonomic risks, and reduce perceived pain scores over the

**Table II. Descriptive and summary statistics comparing intervention and control conditions (n=30)**

| | Intervention Group (n=15) | | Control Group (n=15) | | Interaction Effects | | Main Effects | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Time | | Group | |
| | *M* (SD) | 95% CI | *M* (SD) | 95% CI | *F* | Sig | *F* | Sig | *F* | Sig |
| **Ergonomic Scores** | | | | | 1.396 | .257 | 1.062 | .354 | .557 | .459 |
| Baseline | 16.7 (4.08) | [15.01-18.39] | 14.90 (2.92) | [13.21-16.59] | | | | | | |
| Week 4 | 14.50 (2.73) | [12.26-16.31] | 14.75 (1.04) | [13.71-17.09] | | | | | | |
| Week 8 | 15.00 (2.11) | [13.54-16.63] | 14.14 (.90) | [12.12-16.17] | | | | | | |
| **Ergonomic risk scores** | | | | | 1.218 | .304 | .165 | .848 | .029 | .866 |
| Baseline | 4.00 (1.41) | [3.32-4.68] | 3.40 (.36) | [2.68-4.12] | | | | | | |
| Week 4 | 3.25 (.46) | [2.45-4.05] | 3.80 (.36) | [3.08-4.52] | | | | | | |
| Week 8 | 3.58 (.90) | [2.93-4.24] | 3.43 (.43) | [2.57-4.28] | | | | | | |
| **Pain scores** | | | | | .979 | .326 | 3.030 | ***.050**** | .979 | .326 |
| Baseline | 2.71 (1.54) | [1.98-3.45] | 2.69 (1.55) | [1.93-3.46] | | | | | | |
| Week 4 | 2.08 (1.00) | [1.29-2.88] | 1.73 (1.35) | [.90-2.56] | | | | | | |
| Week 8 | 2.15 (1.57) | [1.39-2.92] | 1.58 (1.08) | [.79-2.38] | | | | | | |

* *p*-values < .05

course of eight weeks. Although all participants reported reductions in perceived pain over the eight-week study, the seated-standing protocol had no effect on ergonomic scores, or ergonomic risks. However, training group participants perceived the seated- standing protocol improved their postures and reduced their perceived pain.

All participants improved ergonomic scores within the time frame of the study but the alternating seated-standing protocol was not shown to have a direct impact on improved postures and risk for musculoskeletal disorders. During the summer 2019 term, the participants were beginning their second semester of patient care. As the students grew more confident with their delivery of dental hygiene care, they may have been able to divert more attention to improving their postures; in the post-study survey three fourths of the training group participants agreed that the seated-standing protocol improved their postures. Previous studies reported in the literature have shown that any improvement in ergonomic scores is beneficial in reducing risks for musculoskeletal disorders.[14, 16, 21-25] Simply being aware of one's posture as part of the process of the delivery of patient care can have long-term benefits especially since musculoskeletal pain has been shown to originate during dental hygiene education.[18,21,22]

Ergonomic risk scores decreased for the training group as compared to the control group, but not to a level of statistical significance. Other indirect objectives of the alternating seated-standing protocol could be found in the reduced risks for systemic diseases associated with seated postures[10-13] and the translation of improved standing postures to seated postures. Most participants found the seated- standing protocol beneficial, as represented in the following comments: "It gave me new ways to clean and move the patient while standing.

**Table III. Training group post-study survey items (n=12)***

| Question | 0-25% of the time | 26-50% of the time | | 51-75% of the time | 76%-100% of the time |
|---|---|---|---|---|---|
| During the first 4 weeks of the study, how well did you follow the protocol to alternate between sitting and standing every 30-60 minutes? | (n=3) 25% | (n=3) 25% | | (n=3) 25% | (n=3) 25% |
| During the final 4 weeks of the study, how well did you follow the protocol to alternate between sitting and standing every 30-60 minutes? | - | (n=6) 50% | | (n=4) 33% | (n=2) 17% |
| | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
| I believe that the sitting and standing protocol resulted in the improvement of my posture and the reduction of my pain. | – | – | (n=4) 33% | (n=7) 58% | (n=1) 8% |
| I believe that the sitting and standing protocol resulted in the improvement of my posture. | – | – | (n=3) 25% | (n=8) 67% | (n=1) 8% |
| I believe that the sitting and standing protocol resulted in the reduction of my pain. | – | (n=1) 8% | (n=1) 8% | (n=8) 67% | (n=2) 17% |
| | **Very unlikely** | **Unlikely** | | **Likely** | **Very likely** |
| In the future, how likely will you stand when providing dental hygiene care? | (n=1) 8% | (n=3) 25% | | (n=2) 17% | (n=6) 50% |

* Voluntary responses from 12 of the 15 participants in the training group are reported.

**Table IV. Open-ended post-study comments, all participants (n=25)***

| Benefits (n=9)Challenges (n=7) | Challenges (n=7) |
|---|---|
| **Alternative postures**<br>• "It was a nice change of pace."<br>• "I had better visibility while standing at times."<br>**Reduced Pain**<br>• "Standing definitely improved my discomfort throughout the day and made it easier doing certain tasks including head/neck cancer screening and periodontal charting."<br>• "I think standing was easier on my back." | **Behavioral changes**<br>• "I prefer sitting than standing."<br>• "I saw and felt the benefits of alternating between sitting and standing during appointments but think it may flow better/be less awkward if I just stood and sat for every other patient (i.e. consistently stand throughout one entire appointment and consistently sit through the next)."<br>• "It was helpful to set a timer to remind yourself to alternate."<br>• "For me, it was honestly hard to remember to alternate between standing and sitting. I feel like we are so used to sitting that is was awkward and felt uncomfortable standing."<br>**Physical limitations**<br>• "Most of my pain occurred during Expanded Functions Dental Auxiliary (EFDA) practice as I was using different muscles and different seating positions. Other than that, clinic hasn't really caused me any pain."<br>• "I feel like I was too tall for the maximum height the chair could rise, so it may have caused me more pain."<br>• "My photographs may not be as helpful due to my loupes magnification not working. My posture isn't always great because it's hard to see." |

* Voluntary responses from 25 of the total 30 participants are reported.

It showed me that standing is sometimes easier than sitting and moving around everywhere" and "I had better visibility while standing at times." However, while self-awareness of one's posture may help reduce the risks for musculoskeletal disorders, the accuracy of this assessment may be challenging. Dental students asked to evaluate their clinical performance were shown to report more favorable self-assessments when compared to the evaluations made by faculty members.[26] Facilitating dental hygiene students' abilities to make more accurate ergonomic self-assessments through photography and faculty feedback may translate into overall improvements in seated and standing postures.

Self-reported perceived pain scores decreased significantly for all participants at week 4 and 8 when compared to the baseline scores. Because the study started after a break in between academic terms, all participants may have experienced more perceived pain at the beginning of the study. As the term progressed, levels of perceived pain may have subsided with more regular and continual clinical practice. Since the perceived pain relied on self-reported data, participants may have been affected by social desirability bias, which leads to underreported pain based on cultural norms. However, the apparent reduction in perceived pain, experienced by the control group, may have been caused by the Hawthorne effect. The M-SNQ instrument has been shown to be an appropriate measurement of interventions on musculoskeletal health and pain.[27] Most participants indicated that the seated-standing protocol resulted in the reduction of their perceived pain. One participant stated, "standing definitely improved my discomfort throughout the day and made it easier doing certain tasks including head/neck cancer screening and periodontal charting" and "standing was easier on my back." Physiologically, seated and other static postures can lead to pain as a response to compressed blood vessels and non-physiologic positions including curvature of the spine.[13] Training group participants may have experienced actual muscular relief associated with changing to the less static seated-standing protocol.

Adherence to the seated-standing protocol may have been a challenge for the training group participants. During the final four weeks of the study, all of the participants reported following the protocol only about 25% of the time. Training group participants reported that, "I prefer sitting than standing" and "it was honestly hard to remember to alternate between standing and sitting. I feel like we are so used to sitting that is was awkward and it felt uncomfortable standing." If students are taught and conditioned to practice in seated positions exclusively, incorporating standing positions in clinical practice may not be considered a viable alternative and may be considered a challenge. Although preclinical instruction is focused on the acquisition of fine motor skills in the preclinical environment,[28] a more holistic approach may be needed including feedback on seated postures and the use of alternative standing positions.

Another contributor to the lack of adherence to the seated-standing protocol may have been the lack of support and feedback from the clinical faculty members. For the present study, the clinical faculty members were instructed to provide periodic verbal reminders to the training group participants to adhere to the protocol and provide ergonomic feedback during the clinical sessions. However, posture and ergonomics are not part of the daily grading rubric and the clinical faculty members do not receive ergonomics calibration training. Professional development programs utilizing captured photographs to illustrate ergonomic positioning has been shown to increase the levels of agreement among clinical faculty members.[15] Future research should include the impact of calibration training with a seated-standing protocol on student postures.

Incorporating self-assessment procedures with the implementation of the seated-standing protocol may affect the impact on posture and perceived pain among dental hygiene students. Previous research on dental hygiene students' self-assessments using captured images of seated postures resulted in improvements in ergonomic scores when using the M-DOPAI[14] and reductions in ergonomic risks using the RULA.[29] Future studies should determine the impact of using self-assessments on seated-standing postures.

The physical limitations of the dental unit may have prevented the full implementation of the seated-standing protocol in this study. One participant commented "I felt like I was too tall for the maximum height the chair could rise, so it may have caused me more pain." Although the mean height of the participants was 66 inches, some of the participants' heights approached 72 inches and may require additional accommodations. Most manufacturers of dental chairs have not considered standing postures for oral healthcare professionals and usually provide height ranges from 13-32 inches.[30] Additional training with the dental unit, particularly the chair, may be needed in the clinic environment. Learning how to fully utilize the semi-supine position of the chair back and the articulating head rest can have a positive impact on student ergonomics as well as patient comfort.

This pilot study had limitations. The small sample size and short time frame limits the generalizability of the results. Future studies should incorporate larger samples from multiple institutions over a longer period to increase the rates

of implementation and determine the impact of the seated-standing protocol. Static photographs were used to evaluate ergonomic scores and ergonomic risks at single points in time. Captured videos could be used to provide ergonomic evaluations based on a series of timepoints in future research. Future studies should The impact of an alternating seated-standing protocol with licensed dental hygienists in clinical practice should also be studied within the context of one hour appointments.

## Conclusion

Although there were no statistically significant differences with the seated-standing protocol on dental hygiene student postures and perceived pain, the participants perceived a positive clinical impact of the protocol on their postures and levels of perceived pain. The results suggest there were minimal impacts of the alternating seated-standing protocol on ergonomic scores, ergonomic risks, or pain. More research is needed to determine whether there are objective benefits to an alternating seated-standing protocol.

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