Effect of Magnification Loupes on Dental Hygiene Student Posture

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Abstract: The chair-side work posture of dental hygienists has long been a concern because of health-related problems potentially caused or exacerbated by poor posture. The purpose of this study was to investigate if using magnification loupes improved dental hygiene students' posture during provision of treatment. The treatment chosen was hand-scaling, and the effect of the timing of introduction of the loupes to students was also examined. Thirty-five novice dental hygiene students took part in the study. Each student was assessed providing dental hygiene care with and without loupes, thus controlling for innate differences in natural posture. Students were randomized into two groups. Group one used loupes in the first session and did not use them for the second session. Group two reversed this sequence. At the end of each session, all students were videotaped while performing scaling procedures. Their posture was assessed using an adapted version of Branson et al.'s Posture Assessment Instrument (PAI). Four raters assessed students at three time periods for nine posture components on the PAI. A paired t-test compared scores with and without loupes for each student. Scores showed a significant improvement in posture when using loupes ($p<0.0001$), and these improvements were significantly more pronounced for students starting loupes immediately on entering the program compared with students who delayed until the second session ($p<0.1$). These results suggest a significant postural benefit is realized by requiring students to master the use of magnification loupes as early as possible within the curriculum.

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Numerous articles have cited postural problems associated with dental hygienists.[1-4] As a result, dental hygiene educators are increasingly concerned about ergonomics. Unfortunately, awareness of this concern has not resulted in significant curriculum changes.[5] An informal email survey conducted in 2004 among members of the Dental Hygiene Educators of Canada (DHEC) revealed that only one institution, Vancouver Community College, has made the use of magnification loupes mandatory. Sunell and Rucker reported that one of the most compelling factors in making the use of loupes mandatory was its recommendation by students, who thought that it was better to become familiar with loupes during their education rather than after they entered employment.[2] Many publications have supported the use of magnification in dental hygiene procedures as a response to this concern.[2,6-8] Although these studies confirm the belief that posture improves with the use of magnification, there was no direct comparison quantifying the difference in posture with and without magnification. To assess the improvement, we designed a quantitative study with controls and appropriate statistical analysis.

As the mean age of dental hygiene students has increased and as hygienists now tend to remain in the workforce longer than in previous decades,[9] the long-term effect of chair-side ergonomics warrants further investigation. A survey of American schools reveals that only 47 percent employ an educator trained in ergonomics.[5] In a profession in which prevention is so important, it seems contradictory that we are not more proactive in teaching and reinforcing good postural habits during the preclinical education of our students. Ashe and Palmer suggest that we take a multidisciplinary approach, teaching ergonomics across the curriculum.[10] However, most researchers cite lack of room in the curriculum for such an approach.[5]

Branson et al.[11] developed a tool, known as the Posture Assessment Instrument (PAI), for measuring posture and applied it in a more quantitative study, measuring student posture with and without loupes. These researchers took a specific dental hygiene skill (periodontal probing) and applied the PAI to measure student posture over a five-minute period. The results showed a quantifiable change in operator position when wearing loupes.

Our study was designed to address Branson et al.'s recommendation that the effect of loupes on operator posture be further researched with more participants performing the more complex skill of hand-scaling. Our study consisted of two phases: a preliminary study to field-test components of the protocol and a formal study.

Methods

All students entering the first year of the diploma program in the School of Dental Hygiene, Dalhousie University in September 2005 were asked if they would participate in this research project. Following an explanation of its rationale and protocol, the students were asked to sign a detailed consent form approved by the Dalhousie University Health Sciences Human Research Ethics Board. Students consented to participate fully in the study and to respond to a follow-up post-survey in their second year of study, with the understanding that they could withdraw from the study at any time if they so chose. Of the forty-two entering novice students, thirty-seven chose to take part, with thirty-five completing the study. One of these students was absent for the preliminary study, but participated in the formal study.

For the clinical exercise, the students were all asked to demonstrate the use of posterior scalers that they normally used in clinic. These were the 7/8, 13/14, and 15/16, all area-specific curettes from Hu-Friedy, Chicago, IL. The students worked in the same two quadrants of the mouth, specifically quadrant 2 and quadrant 4.

Synca Direct/Orascoptic Research Company (LeGardeur, Quebec, Canada) provided the loupes for the study. The loupes were Hires flip-ups, complete with head straps and side shields. The frames were all standard titanium frames, slate in color. Orascoptic also provided three rigid headbands to allow for prescription eyeglass wearers. The headbands and standard frames had interchangeable working lengths to allow for portability within the group. The magnification for all was x2.5. Early in the session, participating students were measured for their working distances, and each was fitted with either the standard frames or headbands, depending on her visual needs.

Raters and Assessment Instrument

The four raters who volunteered were faculty from the Faculty of Dentistry, Dalhousie University. One of the original raters who took part in the preliminary study withdrew due to time constraints, so a replacement rater was included for the formal study. The raters received detailed group instruction on identification of Nield-Gehrig's ideal neutral posture[12] and on recognition of departure from ideal. Each worked independently when assessing student postures.

For the preliminary study, we chose Branson et al.'s PAI to rate the students, as this instrument has been shown to be both valid and reliable.[13] For our formal study, we adapted the PAI to create the Posture Assessment Criteria (PAC), which rate nine posture components: hips and legs (one component), trunk (two components), head and neck (two components), upper arms (two components), and shoulders (two components). These are illustrated in Figure 1. There were two important changes from the PAI for the PAC. First, we omitted the wrist position since, in the preliminary study, the raters were unable to assess this component due to viewing difficulties. Second, the upper arms were included in the PAC as we considered this to be an important area to assess. Since the rating includes only one new component to Branson et al.'s system, we did not consider it necessary to test for reliability and validity. The PAC can be applied to place each component in a category (acceptable, compromised, or harmful) reflecting the degree of departure from Nield-Gehrig's ideal posture.[12] With the exception of the upper arms, the criteria for the three categories are those given in Branson et al.'s PAI.[13] Figure 1 and Table 1 provide the details used for applying the criteria to assess the categories for the individual body components (PAC). Each category can be associated with a numerical score: acceptable components scored zero points; compromised components scored one point each, indicating some departure from the ideal posture; and harmful components scored two points each, indicating further departure from the ideal posture.

The raters assessed the students' posture three times during the five-minute video clip: at one minute, three minutes, and five minutes. Scores were totaled for the three time periods and then averaged across the four raters. Thus, perfect posture, with no departures from the ideal form, received a final score of zero. This indicated that all the body components were deemed acceptable at all times by all four raters. Six components included a possible "harmful" designation; the other three components (hips/legs and shoulders) were designated as either acceptable or compromised. Thus, the worst possible score was a forty-five-point departure from the ideal posture.

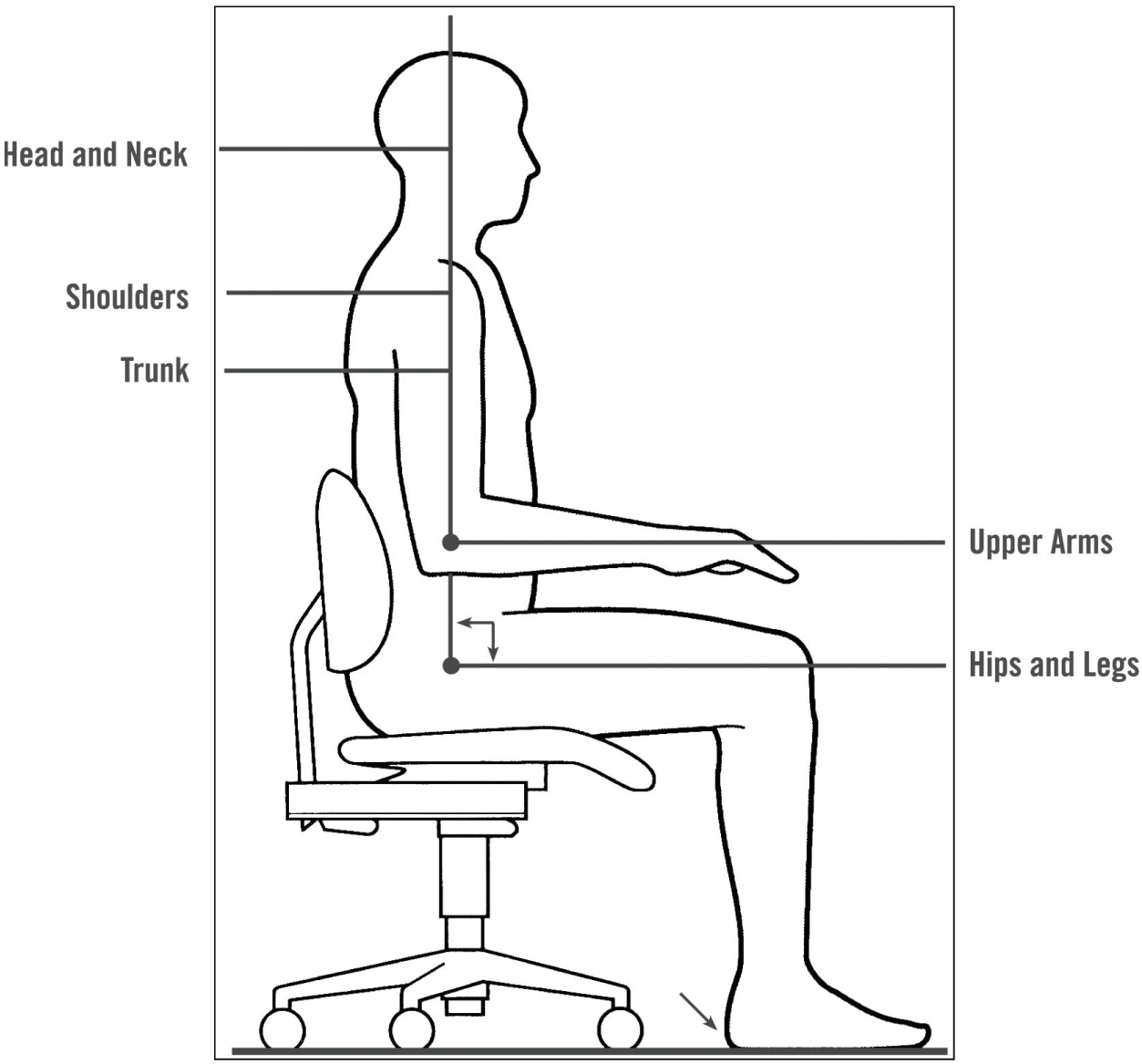

Figure 1. Body components used in the Posture Assessment Criteria (PAC)

This figure shows the ideal body posture, as adapted from Nield-Gehrig JS. Fundamentals of periodontal instrumentation and advanced root instrumentation. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2004:12–22.

However, such a score may have indicated a person with pre-existing physical limitations.

Examples of possible scores are:

a) Every posture component was compromised, but only at one of the measurement times: score=9.
b) Every posture component was compromised at all of the measurement times: score=27.
c) Three body components were harmful at all of the measurement times, but the remaining body components were acceptable at all times: score=18.

Occasionally, a rater was unable to score a body component at one of the time periods due to the camera position. When this occurred, the final score was based on the body component/time periods that

Table 1. Posture assessment criteria (PAC)

Acceptable (0 points)	Compromised (1 point)	Harmful (2 points)
	Hips and Legs	
Hips level on stool; upper thighs parallel; feet flat	Hips not level on stool; upper thighs not parallel; feet crossed, not flat on floor	
	Trunk	
Front to back ≤20° Side to side ≤20°	Front to back ≥20° to ≤45° Side to side >20° to <45°	Front to back ≥45° Side to side ≥45°
	Head and Neck	
Front to back ≤20° Side to side ≤20°	Front to back ≥20° to <45° Side to side >20° to <45°	Front to back ≥45° Side to side ≥45°
	Upper Arms	
Upper arms parallel to long axis of torso Elbows at waist level	≤20° of elbow abduction away from body Elbows at waist level but less than 60°	≥20° of elbow abduction away from body Elbows at waist level but greater than 60°
	Shoulders	
Relaxed Both shoulders level with line of trunk	Slumped forward One or both shoulders elevated above trunk	

Note: This table provides details of application of the Posture Assessment Criteria (PAC) to the nine body posture components. For those body components also used in Branson et al.'s PAI, their assessment categories are retained.

were able to be scored. This happened in less than 5 percent of the cases. Generally, we were able to use the scores for that particular body component at the other time periods. One rater had two cases in which one of the components was not assessed at any of the time periods, so for these cases we used the scores for the remaining body components.

Design of Preliminary and Formal Studies

At the beginning of the semester, the students took part in a preliminary pilot study. This established the protocol for the taping and assessment for the formal study, allowing faculty, students, media service representatives who performed the taping, and faculty raters to become familiar with the process. All the students were videotaped on the same day.

In this preliminary pilot session, the subjects were asked to perform the intra-oral skill of exploring. They were asked to use the Hu-Friedy EXD5 explorer to check the occlusal surfaces of the posterior teeth and the interproximal areas of all teeth. They used only safety glasses or their own prescription glasses. Students were identified by black numbers attached to their white clinic lab coats. The "patients" were fellow students. Cameras were set up directly across from the subjects on portable tripods and staffed by employees of the Media Services Department. Each subject was videotaped for a five-minute period. The videos were downloaded onto a DVD, from which individual DVDs were constructed for each rater. Each individual DVD presented the subjects in a different random order, thus controlling for order effect on rating. The three raters were then able to evaluate individually using the Posture Assessment Criteria (PAC). The raters were unaware of any student's identity; raters were chosen so that there was no prior contact between raters and students to ensure there was no possible bias in the scoring. The results of the preliminary study also provided an assessment of each student's initial posture when entering the program.

Based on their initial postural scores, the students were randomized into two approximately homogeneous groups: the two students with the

highest scores were randomly assigned one to each group, then the two students with the next two highest scores were randomly assigned one to each group, and similarly until finally the two students with the lowest scores were randomly assigned one to each group. Group I wore the loupes for the first session and worked without loupes for the second session, while Group II worked without loupes for the first session and with loupes for the second, so the assignment of the loupes was reversed. Since students were assessed both with and without loupes, they provided their own control for innate posture when testing the effect of the loupes. As the two groups were approximately homogeneous, we were able to control for differences in posture when testing for the effect of session.

Five weeks were allotted for the students to become familiar with the loupes. During this period, they were asked to wear the loupes for all clinical sessions, which comprised two three-hour sessions per week. At the end of this period, in December 2005, the students were videotaped performing the intra-oral skill of hand-scaling. The timing was also designed so that this videotaping would fit within the regular curriculum. For the clinical exercise, the students were all asked to demonstrate the use of the posterior hand-scalers normally used in the Dalhousie University clinic setting. These included the following area-specific curettes from Hu-Friedy: 7/8, 13/14, and 15/16. All students worked in quadrants 2 and 4 of the mouth, and were videotaped for five minutes. DVDs were compiled as in the first session. The only change in protocol from the preliminary session was that the students in Group I were wearing the magnification loupes rather than safety glasses.

For the next session, the groups were switched: Group II now had the magnification loupes, while Group I did not. Another five weeks were allowed for acclimatization before the final taping session took place in February 2006. Again, the timing was designed to allow for the same procedures to be taped during the regular curriculum.

Results and Analysis

For each student, the final scores (averaged across raters) with and without loupes were recorded along with the session (Session 1 or Session 2) for the investigation of the effects of loupes and timing on posture. The individual scores from each rater were included for a further analysis of differences between raters.

Of the thirty-seven students, two withdrew before the study was completed. Both had participated in the initial pilot session. One was unable to participate in the formal videotaping sessions due to scheduling conflicts. The other, from Group II, withdrew after completing the first session. At the start of the second semester, students from Group II expressed some concern that a change in their style of working could negatively affect their clinical progress. However, only the one student chose to withdraw at this time. Data for the two students who withdrew were omitted from the analysis. One student was unable to attend the pilot session, but completed both the formal sessions. This student was included in the analysis of the formal sessions and in the follow-up survey.

The scores from the preliminary study, scoring the students' initial posture on entering the dental hygiene program, were used to randomize the students into two homogeneous groups. Summary statistics are provided in Table 2. The groups were compared using a t-test for independent samples, confirming that there was no significant difference between the two groups at the start of the experiment. The mean scores were 11.29 and 11.02 ($t=0.18$, $df=28$, p-value=0.855).

A comparison after the first session was completed showed that Group I, comprised of those who had been using the loupes, had significantly better ergonomic scores than Group II, those who had not used loupes. Summary statistics are provided in Table 3. Group I had a mean score of 5.69 points from the ideal posture, compared with a mean score of 10.76 points from the ideal posture for Group II ($t=4.37$, $df=23$, p-value=0.0001). This result is statistically significant, providing strong evidence that the loupes

Table 2. Summary statistics for ergonomic scores for the preliminary study

Preliminary Study	Observations	Mean	Standard Deviation
All students	n=34	11.15	4.20
Randomized into Group I	n=18	11.02	3.71
Randomized into Group II	n=16	11.29	4.81

Note: This table shows ergonomic scores for the students at the start of their program. At this time, none of them had experience with magnification loupes. The scores measure the departure from the ideal posture, so lower scores represent better posture. The two randomized groups had similar mean scores (11.02 and 11.29, respectively) at the start of the formal study.

Table 3. Summary statistics for ergonomic scores after the first session

After First Session	Observations	Mean	Standard Deviation
Group I, wearing loupes	n=18	5.69	2.17
Group II, with no loupes	n=17	10.76	4.30

Note: This table shows ergonomic scores for the students after the first session. Group I were assessed wearing magnification loupes; Group II did not wear loupes. The scores measure the departure from the ideal posture; thus, the mean score of 5.69 for Group I shows they have significantly better posture than Group II, who have a mean score of 10.76 ($p<0.0001$).

Table 4. Summary statistics for ergonomic scores after completion of study

Completion of Study	Observations	Mean	Standard Deviation
All students without loupes	n=35	10.8	4.24
All students with loupes	n=35	6.4	2.61
Individual improvements	n=35	4.4	3.88

Note: This table displays the students' ergonomic scores at the end of the study. At this time, every student had been assessed both with and without magnification loupes. The scores measure departure from the ideal posture; thus, the mean score when students were wearing loupes has a departure of 6.4 (s.d.=2.61), showing an overall improvement in posture over the mean score of 10.8 (s.d.=4.24) when students were not wearing loupes. The bottom row shows statistics for individual improvements for working with loupes versus without loupes: on average, students were 4.4 points closer to the ideal posture with loupes, with a standard deviation of 3.88.

improved posture. A 95 percent confidence interval for the mean difference was (2.68, 7.48). This implies that if all students were introduced to loupes immediately upon entering the program, by the end of the first session their average posture scores would improve by 2.7 to 7.5 points, showing practical as well as statistical significance.

After the study was completed, we were able to estimate both the effect of the magnification loupes on the scores and the effect of the time at which the loupes were introduced. Table 4 shows summary statistics for the final scores.

Figure 2 shows boxplots of the scores for all participants when not wearing loupes and when wearing loupes. For the effect of the loupes, we were able to calculate the actual individual improvement for each student by calculating the difference in the scores without loupes and the scores with loupes. The drop in scores when using the loupes reflected ergonomic improvement (Table 4), less deviation from the ideal form, showing better posture. A paired t-test gave significant results (t=6.6625, df=34, p-value=0.0000001), providing strong evidence that magnification loupes improved posture. The associated 95 percent confidence interval for mean improvement in posture was (3.038, 5.704).

For the effect of the time of introduction, we compared the improvement of students introduced to loupes in the first session (Group I) with those introduced to loupes in the second session (Group II). It was expected that students introduced earlier would experience a greater improvement (see discussion below). This was the case: Group I had a mean improvement of 5.23 compared with Group II who had a mean improvement of 3.46. A t-test for independent samples was significant at a 10 percent level (t=1.37, df=32, p-value=0.090<0.1), supporting the hypothesis that early introduction is more effective in improving posture.

A linear mixed effects model for the individual scores for each student (from each rater with and without loupes) was fit using maximum likelihood estimation. Subjects were treated as random effects, whereas the raters, loupes, and session were treated as fixed effects. This confirmed our previous results: there was strong evidence of a difference in scores due to loupes and a significant interaction between session and loupes, indicating that the time at which loupes were introduced was relevant to the improvement in posture from wearing them. It also allowed us to compare the raters. Although there were significant differences due to rater, a separate analysis for each rater was consistent with our overall results, i.e., each individual analysis showed a statistically significant improvement in mean ergonomic score for the times when the students were wearing loupes.

Discussion

When we consulted an expert in each of the kinesiology and chiropractic disciplines, both experts commented anecdotally that any improved change in ergonomic score would be of benefit, regardless of how small the change may be. With a confidence interval for mean improvement of (3.038, 5.704), our

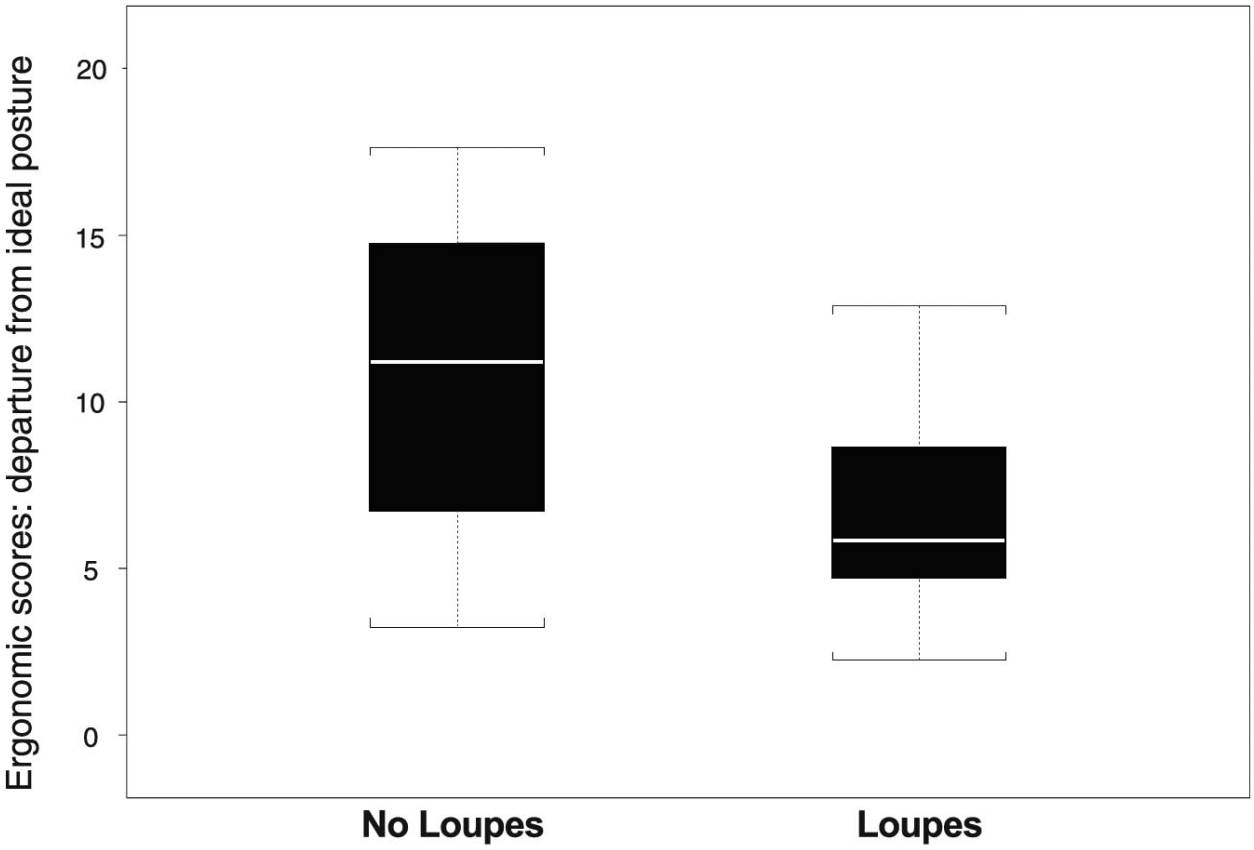

Figure 2. Boxplots of ergonomic scores for students with and without loupes

The left plot shows scores (deviation from the ideal posture) for the students' natural posture when the students were not wearing loupes. The right plot shows scores when the students were using loupes. The maximum score with loupes is well below the 3rd quartile score without loupes, and the median score with loupes is below the first quartile score without loupes, illustrating improved posture when using magnification loupes.

result is clinically significant. We can state with 95 percent confidence that the expected mean improvement in ergonomic scores would be between 3.0 and 5.7 points if all future novice students were to use loupes. This is the estimated average improvement; individual students could experience much greater or smaller improvements. For example, in the current group of students, there were improvements of up to 12.7 points in ergonomic scores. Table 5 shows the sample quartiles for ergonomic scores without loupes, with loupes, and for individual improvements.

Figure 3 shows a scatterplot of scores without loupes against scores with loupes. The identity line, where the two scores would be the same, is shown on the plot. Observations above the identity line represent students whose posture improved when wearing loupes. The upper left part of the plot shows students who had large scores without loupes (i.e., their default posture was not good) but who had low scores (i.e., good posture) with loupes. These students benefited greatly from wearing the loupes. Observations that are farthest from the line show the greatest improvement. For students with observations close to the identity line, the loupes had little effect on their posture. The four students who had scores below the line actually had worse posture when wearing loupes. These students were the ones with the best innate posture and would have had little room for improvement. Of these four, three were very close to the identity line (within one point), and the fourth student was three points away. For students with observations

Table 5. Quartiles for ergonomic scores at completion of the study

Completion of Study: Quartiles	Min	Q1	Median	Q3	Max
All students without loupes	3.25	6.75	11.25	14.75	17.63
All students with loupes	2.25	4.75	5.88	8.63	12.88
Individual differences in scores	-3.00	1.63	4.00	6.63	12.75

Note: This table shows the quartiles (minimum, 25th percentile, 50th percentile, 75th percentile, and maximum) for ergonomic scores at the end of the study. At this time, every student had been assessed both with and without magnification loupes. The first row gives quartiles for scores when students were wearing loupes. The second row gives quartiles when students were not wearing loupes. The bottom row shows quartiles for individual improvements in posture when students were wearing loupes.

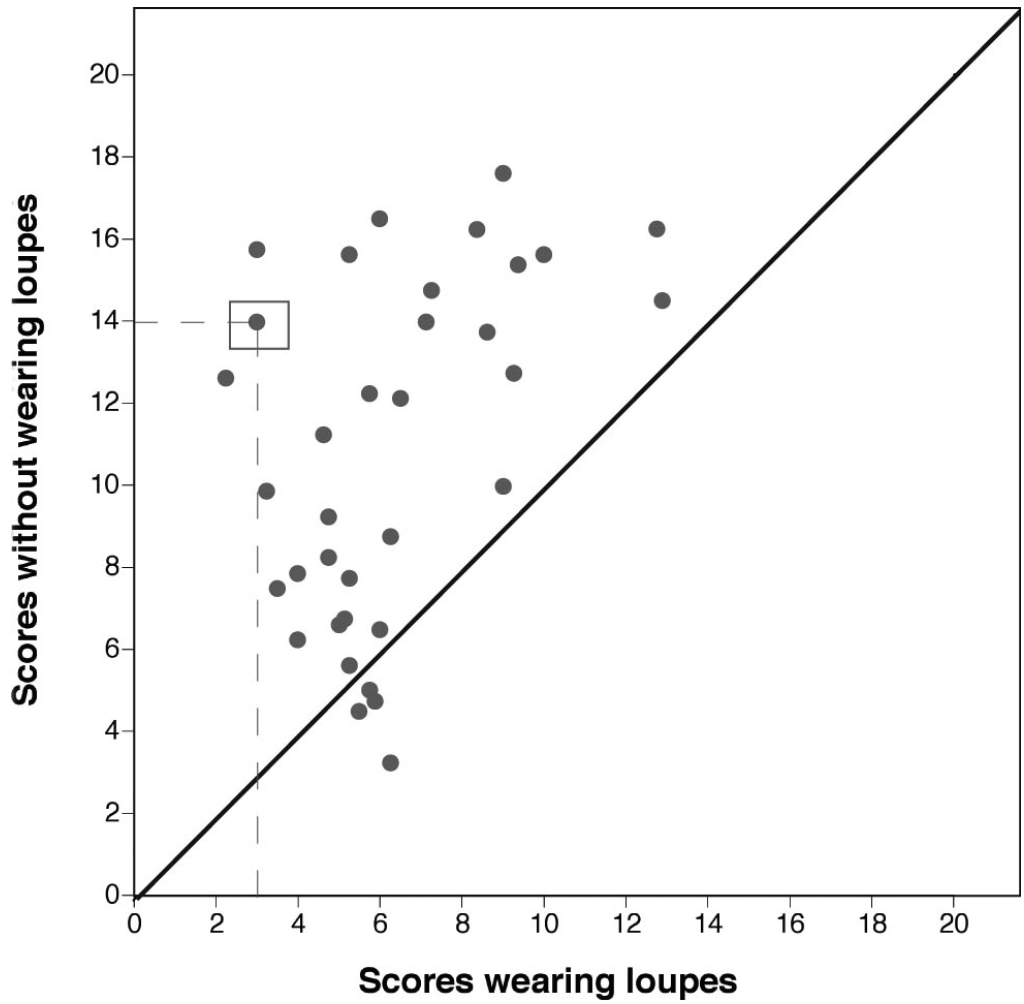

Figure 3. Scatterplot of natural score without loupes against score with loupes

Each point on the plot represents an individual student. Points above the identity line represent students who had an improved score when wearing loupes. For example, the point indicated with a box shows a student with a score 14 points away from the ideal posture without loupes (14 is the value on the vertical axis); the same student had a score only 3 points away from ideal with loupes (3 is the value on the horizontal axis). The improvement of 11 points is illustrated by the distance of this point above the identity line.

close to the line, the loupes had little effect. Scores would vary from day to day, so for these students the impact of loupes was probably less than day-to-day variation in their posture.

Our results were in keeping with those of Branson et al.[11] Following their recommendations, we used a more complex clinical skill, scaling/root planing, whereas their subjects performed probing. The paired t-test comparing our scores with and without loupes was more powerful than the equivalent test for Branson et al.'s data, as again following their recommendations, we had a larger number of subjects (n=35 vs Branson et al. with n=19). This is illustrated in the p-value of almost zero (p=0.0000001) for our data, whereas Branson et al.'s test gave a p-value of 0.19.

Second-session Group II students were much less compliant in their use of loupes compared to Group I in the first session, and their use of the loupes was observed by faculty to be much less consistent. We believed that this lack of compliance would lead to a smaller improvement for Group II (second-session loupe) students. As shown in the results, the students in Group I had a greater mean improvement than did Group II, indicating that the time at which loupes are first introduced is relevant to the benefits experienced from wearing them. Crossover studies usually assess possible carryover effects, and it is possible that students introduced to loupes could have retained their improved posture even when working without loupes. However, any such effect would be effectively disguised by the stronger effect of the lack of compliance by Group II in the second session. If there was in fact a carryover effect for Group I, then the timing effect would be even greater than that estimated. Based on these results, we strongly recommend the introduction of loupes at the beginning of the program. We are not aware of any other study that compared the effect of the timing for introducing loupes.

We observed large differences between raters. For example, one rater was consistently generous to the students, showing a reluctance to criticize their posture, while at the other extreme, one rater was highly critical, consistently recording each slight discrepancy from the ideal form. However, each rater was individually consistent in applying the criteria. Given the commitment of time for the actual assessment process, especially with a large sample size, we recommend a longer training session for the raters. This might actually decrease the overall time commitment, as raters would be able to assess the posture components more quickly and accurately. It should also reduce the differences between the raters.

In the fall of the second year (approximately seven months after participating in the loupes study), the students completed a post-study survey. In the first part of the survey the questions were modeled on the post-reflection study done by Branson et al.[11] The second part of the survey supplemented Branson et al.'s survey and addressed the students' interest in buying and using loupes for future clinical practice. The results are shown in Table 6. The majority of

Table 6. Summary of student survey results, n=32

General Comfort			
Weight of the loupes	Heavy 6%	Moderate 74%	Light 21%
The loupes are	Hard to wear 29%	Adaptable 59%	Easy to wear 12%
Time for adjustment	Less than a day 15%	2-4 clinic days 56%	Never 29%
Comfort	Comfortable 23%	Both 68%	Uncomfortable 9%
Symptoms			
Vertigo	Yes 35%	No 65%	
Eye soreness	Yes 38%	No 62%	
Clinical Skills			
Clarity of oral cavity	Increased 91%	Unchanged 9%	Decreased 0%
Ability to adapt to an instrument	Increased 59%	Unchanged 21%	Decreased 21%
Quality of work	Increased 44%	Unchanged 50%	Decreased 6%
Posture			
Improved	Yes 78%	No 22%	
Cost and Use			
Will the use of loupes allow longer time in private practice?	Yes 63%	No 37%	
If, in your future clinical practice, loupes are available at no charge, would you use them?	All of the time 41%	Some of the time 50%	Never 9%
If loupes were subsidized so the cost to you was under $100, would you purchase the loupes?	Yes 75%	Not sure 19%	No 6%

students were aware of improved posture, perceived that the quality of their work increased when wearing loupes (Figures 4A and 4B), and would wear loupes if they were provided (Figure 4C).

However, cost was a factor. Most students would not buy loupes at the regular price, although they would if the cost were subsidized (Figure 4D). This was not surprising, as most students participating in this study were not in a strong financial position.

Table 7 shows the relationship between the students' interest in wearing loupes and their perception of their posture and the quality of their work. Thirteen students indicated they would wear loupes at all times if loupes were provided, and all of them perceived an improvement in posture when wearing loupes. Eleven of them also believed the quality of their work improved, while the remaining two believed the quality to be unchanged. Sixteen students

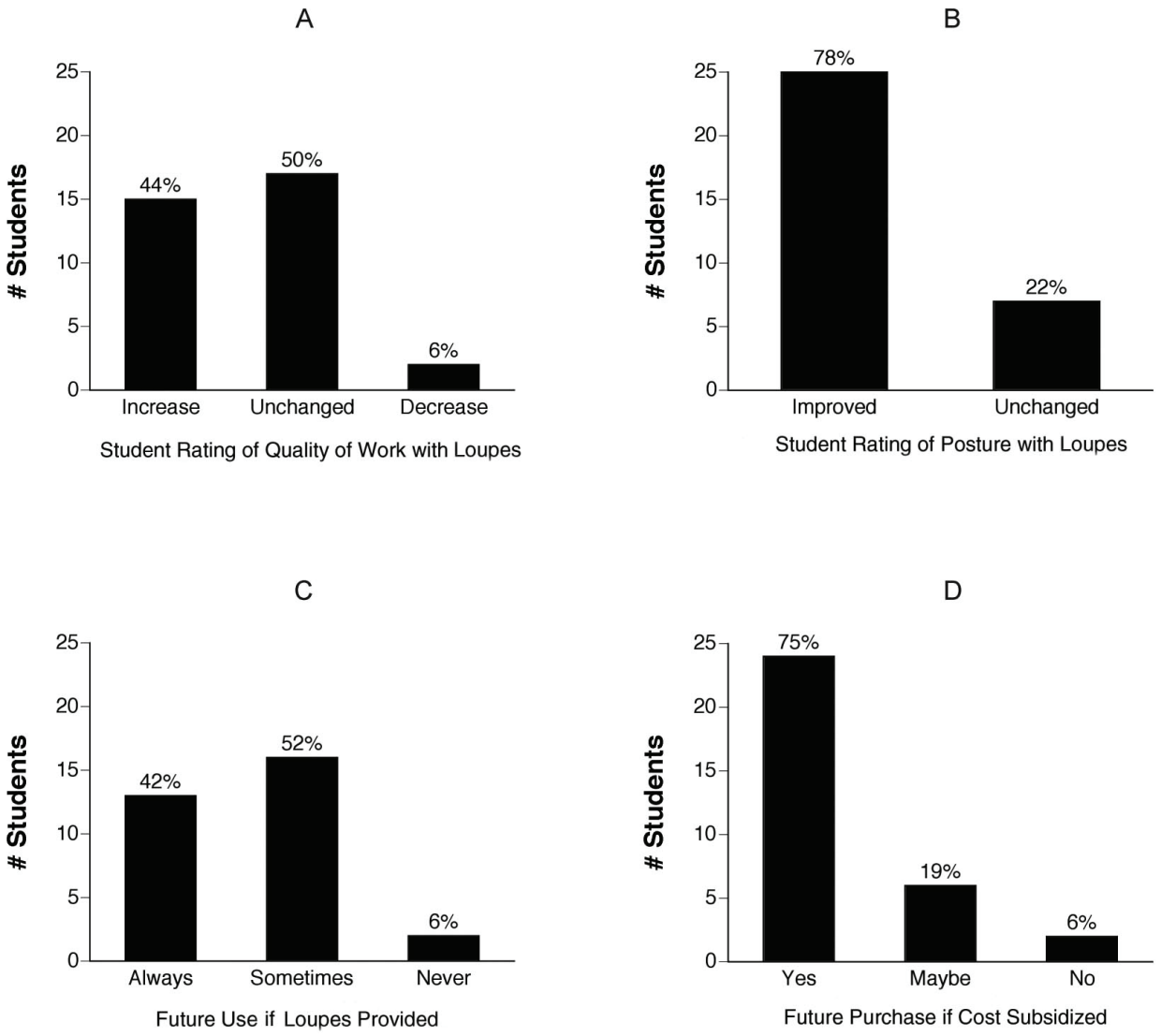

Figure 4. Main results of student survey

The upper plots show the students' perception of the effect of loupes on the quality of their work (Plot A) and their posture (Plot B). The lower plots show the students' interest in using loupes in a clinical setting (Plot C) or purchasing loupes if available at a subsidized price (Plot D).

would choose to wear loupes for some of the time; of these, eleven experienced an improvement in their posture. For these eleven, two believed the quality of their work was improved by wearing loupes, seven thought it was unaffected, and two believed the quality decreased. There were only three students who would not choose to wear loupes even if they were provided at no cost. One of these three experienced an improvement in posture, and all three believed the quality of their work was unaffected. Students who directly experienced an improvement in their posture were more likely to choose to wear loupes. Similarly, students who believed the quality of their work increased were more likely to wear loupes. Table 8 shows similar relationships between the students' perceptions of their posture and quality of their work and the students' interest in actually purchasing loupes.

In the first part of the survey we can directly compare our students' responses with those of Branson et al.[11] Overall, our students found the loupes less comfortable. For example only 15 percent of our students adjusted in less than a day compared to 57 percent in Branson et al.'s survey. We had 48 percent, compared to Branson et al.'s 5 percent, reporting eye soreness. However, it should be noted that, in spite of these complaints, we still had over 90 percent of our students reporting they would use loupes if they were provided. We do believe the students' general comfort would be improved with assistance in adjusting to the loupes when they are first introduced.

Conclusions and Recommendations

We strongly recommend use of loupes for dental hygiene students, to begin as early in their entrance year as possible. To make this change, faculty would also have to be familiarized with loupes. Faculty would have to commit to be calibrated in their adherence to good ergonomics in the clinical setting, both by role modeling the actual wearing of loupes and by monitoring the students' posture and adherence to using loupes. The cost of the loupes would have to be factored into tuition; this would allow students to claim them as an expense on their student loan application if applicable. Companies providing loupes for dental hygiene students should provide more education for faculty. For students who are experiencing problems adapting to the loupes, these companies should be more active in providing support. This could be done by providing representatives on campus for technical support during the

Table 7. Relationship between students' interest in using loupes and their perception of posture and quality of their work when wearing loupes

		Wear loupes if provided?					
		Always		Sometimes		Never	
Improved posture?		Yes	No	Yes	No	Yes	No
Quality of Work	Increased	11	0	2	2	0	0
	Same	2	0	7	3	1	2
	Decreased	0	0	2	0	0	0

Note: Of the thirty-five students, only three would choose not to use the loupes if they were provided. For the thirty-two who would wear loupes, thirteen would use them at all times.

Table 8. Relationship between students' interest in owning loupes and their perception of posture and their quality of work when wearing loupes

		Buy loupes if subsidized?					
		Yes		Maybe		No	
Improved posture?		Yes	No	Yes	No	Yes	No
Quality of Work	Increased	13	2	0	0	0	0
	Same	5	2	4	2	1	1
	Decreased	2	0	0	0	0	0

initial period when the students are acclimatizing to the loupes.

The use of magnification loupes significantly improved posture for dental hygiene students in our study; greater improvements were found for students starting to use loupes immediately on entering the program (the difference between the two sessions is significant at the 0.10 level). Based on these findings, we strongly recommend that all dental hygiene students be provided with magnification loupes at the start of their training program, although we realize there are financial implications that may influence implementation of this policy.

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