Magnification Loupes in U.S. Entry–level Dental Hygiene Programs – Occupational Health and Safety

Leslie McHaney Congdon, BSDH, MS; Susan Lynn Tolle, BSDH, MS; Michele Darby, BSDH, MS

Abstract

Purpose: The purpose of this study was to determine policies and practices regarding magnification loupes among faculty and students in accredited dental hygiene programs as measured by a 31 item, self–designed questionnaire. In addition, the study compared policies among dental hygiene programs in 2 year versus 4 year programs in terms of requirements for the use of magnification loupes.

Methods: After institutional review board approval, a 31 item self–designed questionnaire was emailed via Survey Monkey to 303 entry–level dental hygiene programs. An overall response rate of 75% was obtained. Data were analyzed using descriptive statistics and chi–square test of independence.

Results: Results reveal the vast majority of programs do not require loupes for faculty or students, with only 23% of responding schools requiring students to purchase loupes and 8% requiring faculty to use loupes. More dental hygiene programs require students to wear loupes than require faculty to wear loupes. No statistically significant differences (p–value=0.54) in program policies were found requiring the purchase of magnifying loupes by students, based on 2 year and 4 year dental hygiene educational programs. Odds ratio (1.25) give the odds of students purchasing loupes in a 2 year program as 25% higher than a 4 year program. Almost two thirds of respondents reported loupes instruction as a curriculum component, although most respondents spent 2 or less hours teaching in this area. Most programs (90%) do not plan to require students to purchase loupes in the future, although the majority believes proper use of loupes should be integrated in the curriculum.

Conclusion: Most respondents see advantages to loupes, but clinical policies on loupes do not appear to correlate with beliefs. Educational programs in dental hygiene seem slow to adopt and require the use of loupes. Current clinical polices on loupes should be reviewed to ensure graduates experience the potential ergonomic benefits magnification brings to clinical practice during their education.

Keywords: magnification loupes, dental hygiene students, dental hygiene programs, dental hygiene faculty, dental hygiene programs, survey, dental hygiene curriculum

This study supports the NDHRA priority area, **Occupational Health and Safety:** Investigate methods to decrease errors, risks and hazards in health care.

Introduction

The high incidence of musculoskeletal injuries in dental hygienists is a well documented occupational concern.[1–6] To address this concern, the American Dental Hygienists' Association's (ADHA) National Dental Hygiene Research Agenda addresses occupational health and safety with emphasis on the impact of exposure to environmental stressors on the health of users and methods to decrease errors. If learned and used, one technology that may reduce environmental stressors, improve occupational health of dental hygienists, enhance treatment and improve ergonomics during patient care is magnification loupes.[7,8] Designed fundamentally to enhance the visual acuity of practitioners, magnification is promulgated to promote good posture, essentially assisting practitioners in staying in a neutral body position while providing care, resulting in reduced musculoskeletal stress.[9–11] An ergonomically correct neutral body position includes a neutral position for the neck, back, shoulder, upper arm, forearm and hands, which may be achieved when properly fitted loupes are worn during clinical practice.[12,13]

Inherent in understanding the use of magnification loupes in medicine and dentistry is the premise that increased image size will positively impact treatment.[9,10] In dental hygiene, better visual acuity through magnification may facilitate improved assessment of the hard and soft tissues of the head and neck, resulting in improved diagnosis and

treatment.[11–13] Visual evaluation of radiographs, crown margins, existing restorations, periodontal probing readings and clinical attachment level assessments, carious lesions and calculus detection may be improved with increased image size.[11] Better visual acuity through magnification may make subtle tissue changes more discernible and improve instrument sharpening skills. Therefore, use of magnification loupes have the potential to enhance client treatment and therapeutic outcomes, as well as enhance the musculoskeletal health of oral care clinicians. For these reasons, more dentists, dental specialists and dental hygienists are utilizing loupes in private practices and educational settings.[14,15]

The inclusion of magnification in dental hygiene curricula is important since it may enable students to better assess clinical details, as well as assess overall oral health status of patients. In the long term it may better prepare future dental hygienists to meet the increasingly complex oral health needs of the public and influence student and faculty retention via the promotion of musculoskeletal health, quality of work and a productive work life. However, studies in dental and dental hygiene educational programs involving magnification eye wear are limited. Those that are available report postural benefits but few have been able to document improvements in patient care.[16–25]

Maillet et al found significant postural benefits for dental hygiene students if they became more proficient with the use of loupes early in their education, and when they were hand scaling.[17] Branson et al[18] reported a relationship between dental hygienist students' posture and the use of loupes, potentially decreasing musculoskeletal problems with similar findings reported by Sunnell et al[19] in their study of dental hygiene students where participants reported decreased neck, shoulder and back pain with the use of loupes.

Leknius and Geissberger revealed the use of loupes among dental students has been shown to reduce clinical errors by 50%,[24] although another study found no significant differences in the quality of cavity preparations done by dental students using loupes and dental students using safety glasses.[20,21] Meraner and Nase's survey of teaching faculty members at a school of dentistry revealed almost one half of the faculty used loupes.[22] Most respondents indicated loupes significantly benefited occupational health and diagnostic abilities of the dentist and patient care delivered, and almost three fourths indicated that wearing loupes should be mandatory for students in the program. Of the faculty respondents, 61% reported they always discuss the importance of loupes with students.

Thomas et al explored the opinions of practicing dental hygienists on loupes and found 85% of those surveyed believed loupes were or would be advantageous while in school, but most respondents did not think they should be required.[16] The most highly reported perceived advantages of loupes include ergonomics (91.5%), improved probe readings (78.5%), calculus removal (73.3%), caries detection (64.6%) and quality of care (65.2%). The most highly reported disadvantages included adjustment period (46.2%), vision dependency (31.2%), infection control (27.3%) and limited depth of vision (23.6%).

Research suggests that dental hygiene students may benefit from the early use of loupes prior to developing bad postural habits.[17] Dental hygiene programs must teach the most effective techniques and interventions and model the highest standards of professional practice so that graduates can provide quality care and have successful professional careers. Currently, use of magnification loupes is not curricular content required by accreditation standards, nor is it reflected in nationally accepted dental hygiene curriculum guidelines as a best practice. However, the use of magnification glasses continues to increase in dental practice settings due to potential ergonomic benefits. The literature is void of evidence that demonstrates the degree to which dental hygiene schools have embraced loupes as an essential part of entry–level education and clinical practice. This research helps fill this void and may assist faculty with making valid and reliable decisions regarding the future direction of their program's curriculum loupes policies. Consequently, a nationwide survey was needed to assess the policies and practices in the U.S. entry–level dental hygiene programs to determine whether loupes were utilized in the educational environment.

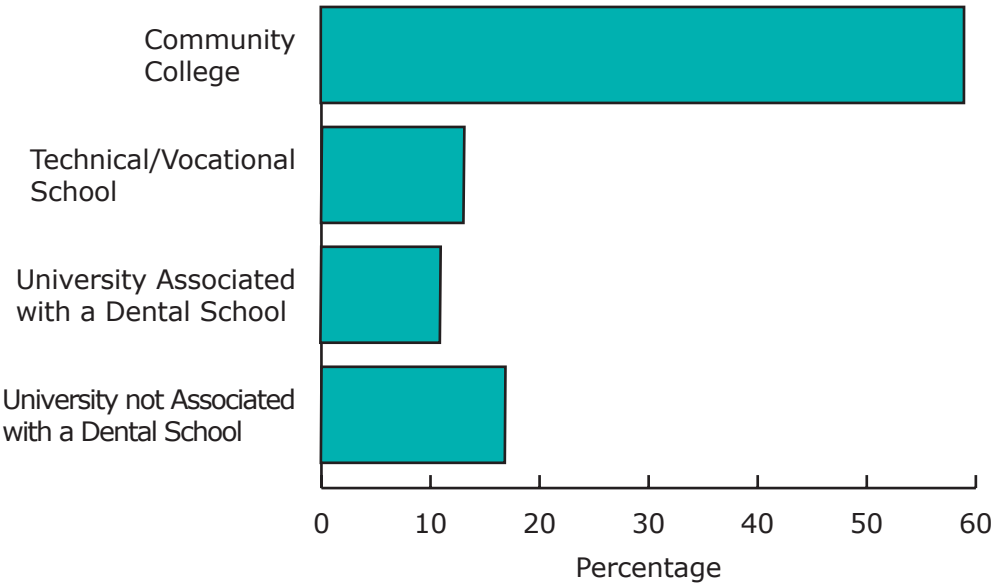
The purpose of this study was to determine the policies and practices regarding magnification loupes among faculty and students in entry–level dental hygiene programs accredited by the Commission on Dental Accreditation of the American Dental Association, as measured by a self–designed questionnaire. In addition, the study compared policies among dental hygiene programs in 2 years versus 4 years programs in terms of requirements for the use of magnification loupes.

Methods and Materials

A 31 item self–designed questionnaire was developed to determine polices concerning use of

magnifying loupes by students and faculty in all accredited U.S. entry–level dental hygiene programs (n=303). The survey consisted of 12 yes/no questions, 6 multiple choice questions, 8 questions that were open–ended response count, 4 Likert–scale questions and 1 comment section to allow for elaboration. Several questions with specific answers also allowed for explanation. The first section requested demographic information, such as respondents' title and affiliation. The next segment solicited programs' current loupes policy for students, the estimated number of students that purchased loupes, when students should begin to wear loupes and identified all items they believed to be advantages/disadvantages of loupes. The third portion pertained to faculty policies on loupes. Finally, participants gave feedback regarding ergonomics of loupes inclusion within curriculum.

Table I: Total percentage of respondents from all educational settings



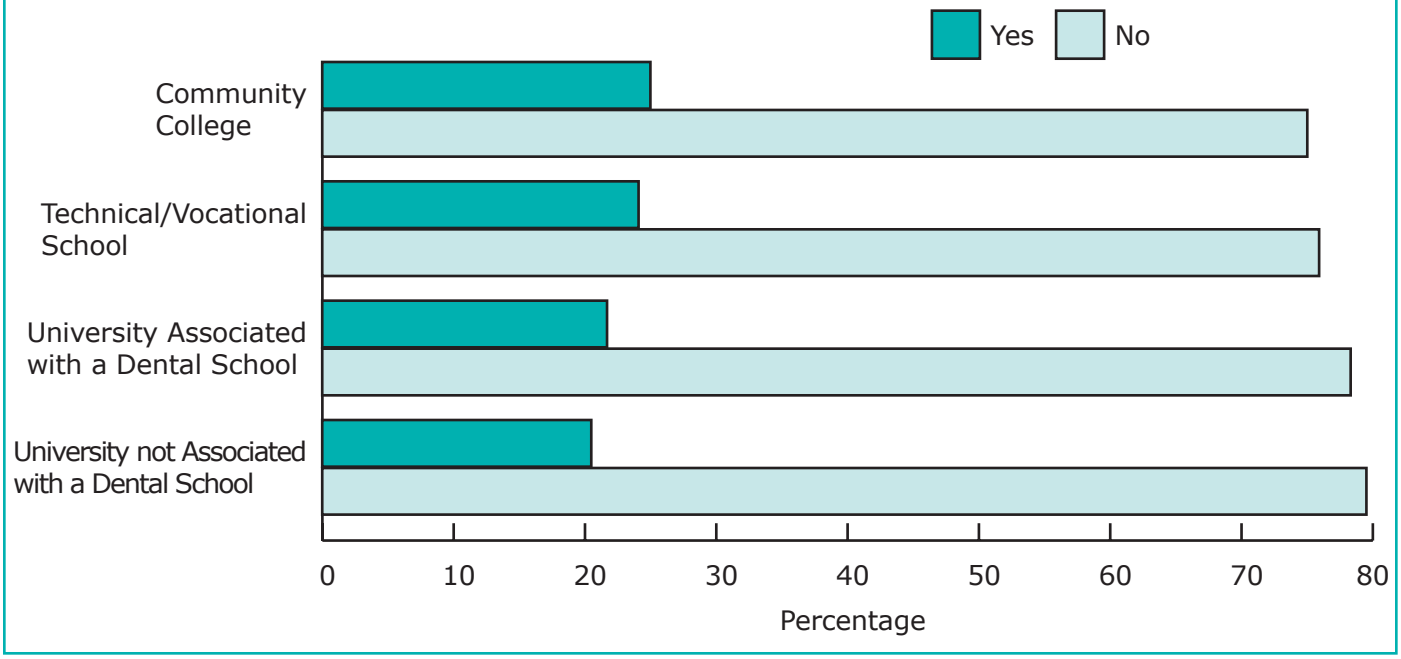
Following approval of the university institutional review board, the survey was pilot tested on 10 dental hygiene faculty. Comments and suggestions were incorporated into the final survey instrument to improve content validity and clarity. A current master list of accredited U.S. entry–level dental hygiene programs was provided by the ADHA. A cover letter and the self–designed questionnaire Magnifying Loupes in U.S. Entry Level Dental Hygiene Programs were distributed to the program director of each college/university, using a commercial web–based software company (Survey Monkey). The cover letter explained the research was supported by a grant from the ADHA Institute for Oral Health, explained the purpose of the study as well as the approximate time it would take to complete (20 to 30 minutes) and requested the recipient respond to the questionnaire or forward the survey to the most qualified faculty member for completion. The cover letter also explained results would be reported in aggregate form only and individual responses would be anonymous. One week after the initial electronic mailing, a second distribution of surveys was launched to non–respondents. A third distribution of surveys was launched to non–respondents 2 weeks later due to the fluctuating college winter breaks. The survey was closed 3 weeks after the third electronic mailing.

Data were collected and tabulated by Survey Monkey, and statistical analysis was performed using JMP version 8.0.2 software. Quantitative analysis of data utilized percentages, frequency distribution and Pearson's Chi–square test. The significance level was set at 0.05.

Results

A total of 303 surveys were electronically mailed (n=251 for 2 year programs, n=52 for 4 year programs). Of those, 236 were returned for an overall response rate of 75% (227). Seventy–three percent of respondents were from 2 year programs and 27.9% were from 4 year programs, with a breakdown by type of program presented in Table I. Most respondents (76.2 %) did not require students to purchase loupes. Of the 23.8% who did require loupes purchase, 21.3% were from community colleges, 17.2% from technical/vocational schools, 21.7% were universities with dental school and 17.9% were universities without dental school (Figure 1). Of the 78% of programs that do not require loupes, 35% reported over half of their second year students voluntarily use loupes and 15% reported their whole second year class voluntarily uses loupes. Results reveal slightly more schools (23.8%) required purchase of loupes than mandate their actual use (20.3%). No statistically significant differences were found (p=0.54) in dental hygiene educational program policies requiring the purchase of magnifying loupes by students, based on 2 and 4 year programs. However, odds

Figure 1: Dental hygiene program policy requiring loupes for students



ratio (1.25) give the odds of students purchasing loupes in a 2 year program as 25% higher than a 4 year program.

Almost all participants viewed ergonomics as an advantage of wearing loupes (93%), followed by improved periodontal probe readings (90.3%), caries detection (69.6%), restorative evaluation (69.6%), decreased musculoskeletal pain (68.3%), improved patient care (61.2%), radiographic interpretation (59.5%) and calculus detection. Disadvantages identified included: expense (86.7%), adjustment time (37.2%), limited depth of field (26.1%), infection control (25.7%), uncomfortable (17.3%), dependency (16.8%) and headache (14.6%). Comments from participants are found in Table II.

Table II: General Open Ended Comments from participants on Loupes usage

- Cost prohibit mandating
- Difficulty attaining consensus among faculty
- Do not require loupes but we recommend them to students
- Too much additional information for students
- Alter natural vision/ dependency
- Inhibit development of tactile sensitivity
- Which brand/company to recommend
- Arbitrator between student and company
- Implies dental hygienist need loupes to be efficient
- Some students cannot adapt
- Loupes too heavy
- Not proven to enhance treatment

Just over one third of respondents indicated the ideal time students should begin to wear loupes was during pre–clinical education, with 1 of 4 respondents indicating the second year was the best time to begin to wear loupes. Combining pre–clinical and first year results reveals 63.4% consider students' first year ideal. Chi square results reveal a statistically significant difference between schools that require loupes and those that do not when comparing when students should first begin to wear them (p=<0.0001). Of the programs that required students to purchase loupes, the majority (64.8 %) indicated pre–clinic is when students should begin wearing loupes, with just under 10% indicating the senior year (Figure 2).

More than half of faculty respondents indicated they always or almost always used loupes in clinic, although an overwhelming majority of respondents (90%) indicated they did not have program polices requiring faculty to purchase and use loupes in the clinical setting. However, of the programs that required students to purchase loupes, results suggest more lenient polices for faculty, as 66% of the programs that require student to purchase loupes do not require faculty to do so. No statistically significant difference (p–value=0.27) were found between 2 and 4 year dental hygiene educational programs for faculty use of magnifying loupes in the clinical setting.

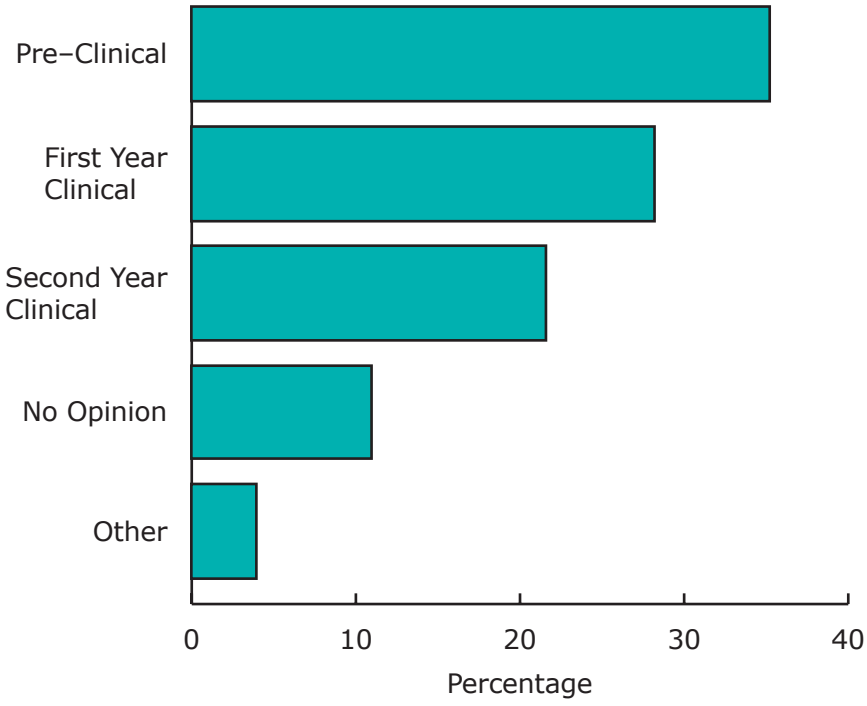
Very few institutions paid for faculty loupes, with only 10% paying for full–time faculty and 3.9% for part time faculty's loupes. About 77% of par-

ticipants indicated loupes were integral in private practice, while 23.2% did not see loupes as integral to practice in the private sector. Most programs (90%) do not plan to require students to purchase loupes in the near future, although the majority (73%) believe proper use of loupes are integral to the curriculum.

Most participants (62.5%) indicated they had ergonomic instruction on magnification loupes as a component in the curriculum. Of those respondents that cover the topic, almost 70% spent 2 or less hours on loupes and many relied solely on the loupes' sales representative for all loupes instruction.

With 76.8 % of respondents indicating loupes are integral to private practice, only 62% identified ergonomics instruction on magnification loupes as a curriculum component. Of those respondents that cover the topic, almost 70% spend 2 hours or less on loupes training.

Figure 2: Dental hygiene program perspectives on when students should begin to wear loupes



Discussion

This study examined polices on magnification loupes in dental hygiene programs. Results suggest schools of dental hygiene have been slow to adopt the use of loupes in their curricula. Most schools do not require students or faculty to purchase loupes. The ergonomic benefits of loupes are well supported in the literature and concern is generated when so few schools are requiring students to wear loupes.[8–15] While research has documented the ergonomic benefits of loupes, few studies have documented improvements in oral diagnosis and treatment by the loupes wearer.[8–12] Perhaps some schools may not have policies that require loupes due to the lack of scientific data available that demonstrate improvements in patient care as a result of magnification. Sunnell and Rucker also argue that surgical magnification may not be as important for dental hygienists due to their periodontal focus that relies on subgingival instrumentation and tactile sensitivity more than visual acuity.[22] Although this reasoning ignores the issue of posture and musculoskeletal malady, it leads to another possible explanation for this study's results, where over three quarters of the responding dental hygiene programs do not require loupes.

Another plausible explanation for a low number of schools requiring students and faculty to wear loupes is cost. Almost all respondents cited cost as the greatest disadvantage of loupes, which was also reported by Thomas et al as the greatest disadvantage.[16] Ranging in price from $400 to $1,200, the added expense may appear overwhelming in light of numerous instruments, supplies and lab fees students must incur when enrolling in a dental hygiene program. The benefits have the potential to outweigh the cost, when years of improved ergonomics may result in fostering a longer and more productive career in clinical practice. Several respondents' comments echoed explanations as they cited indecision on which company to use, arbitration between students and manufacturer, difficulty attaining consensus among faculty and not mandating use of loupes in the clinical setting, claiming treatment benefits are not proven (Table II).

Results from this study suggest dental hygiene programs require loupes for students more often than faculty. This result might be explained by some faculty not viewing themselves as direct care providers and hence the need for magnification eyewear would not be as great as for students. Additionally, some faculty may see their role as less demanding ergonomically since they often spend less time than students actually working in a patients' oral cavity.

Odds ratio reveal a greater probability of 2 year programs requiring students and faculty to purchase loupes than 4 year programs. A possible explanation of the student finding could be the lower cost of instrument kits and supplies in 2 year programs, although this data was not obtained Another cost factor could be related to tuition, as the American Dental Association reports tuition in 2 year schools as substantially less on average than 4 year schools housed in universities and dental schools.[26]

Results varied concerning the best time students should begin to wear loupes. However, the programs that required loupes more frequently indicated pre–clinic as the optimum time to start wearing loupes when compared to all respondents. The varied findings in this study may be due to those programs that require loupes being more familiar with how they can assist students at all levels of clinical learning since they have more experience with them compared to other schools. As suggested by Maillet et al, an early start with loupes may reinforce neutral positioning and enhance posture early in the educational process before improper habits are learned.[17] Students can become comfortable with loupes during instrumentation on typodonts prior to treating patients. Some schools may also mandate an early integration of loupes in pre–clinic since they find it beneficial to have students incur this expense at the same time as other instrument, lab fees and supply expenses covered by outside sources, such as student loans or grants. Roughly 1 in 4 respondents indicated the second year as the optimum time to start wearing loupes. Perhaps faculty believe learning pre–clinical skills such as indirect vision, tactile sensitivity and other instrumentation basics is best learned first with unmagnified vision. The lack of supportive research on clinical benefits may be another plausible explanation for faculty not requiring use of loupes in pre–clinic courses.

One half of respondents report wearing loupes while teaching in the clinic, which is similar to findings from a survey of dental school faculty.[19] However, only 10% of respondents had program polices that required faculty to wear loupes. Apparently many faculty believe the wearing of loupes have advantages but not enough to mandate their use. Faculty need to be role models for students. If program policies do not reflect that loupes are important for faculty, many students may not view loupes as advantageous enough to incur the expense unless mandated. With expenses continuing to rise and budgets continuing to decrease in many institutions, it is not surprising that few schools paid the cost of loupes for faculty. If the expense was covered by the institution, polices would predictably change since respondents see many advantages to wearing loupes.

Of the programs currently not requiring loupes, few plan to change their policy in the future. This is unfortunate since musculoskeletal health of students and faculty could be affected.

The majority of responding faculty reported they include loupes ergonomics instruction as part of the curriculum. However, the one third of respondents that do not cover this topic in their curriculum may be doing a disservice to their students. These schools may wish to evaluate their curriculum to ensure coverage of this important topic so tomorrows practitioners have a full realm of options for ergonomically sound dental hygiene practices. Beach et al reported the majority of programs did not offer ergonomic education beyond patient/operator positioning due to lack of room in curriculum.[21] This could be a possible reason for the low number of hours found in this study that was devoted to loupes education.

Since proper fit is integral to the successful use of loupes, students need to be measured in the clinic with a patient in the chair to attain the proper patient–clinician distance, as well as the angle of the telescopes. Therefore, curriculum should have both a clinical and didactic component. Manufactures of purchased loupes must be obliged to provide initial and follow–up instruction, as well as clinical support as needed to obtain optimum outcomes since proper loupes fitting is outside of the role of most faculty.

In summary, clinicians often slouch or bend to enhance their visual perspective and risk serious cumulative injury.[1–6] Loupes can aid in reinforcing proper ergonomics, musculoskeletal health and greater visual acuity with less eyestrain. This could result in prolonged physical health, dental hygiene careers and greater visual acuity resulting in enhanced patient management.

There are limitations to the current study. Results can only be generalized to the responding population and may not represent all dental hygiene programs. This present study did not elucidate the student perspective which could impact results. The questionnaire did not clearly define pre–clinic from first year clinic, which may have confused respondents.

Future studies need to be conducted to determine if visual magnification improves student performance, the most optimal time loupes should be

introduced into curriculum and student opinions of the value of loupes in clinical practice. Research is also needed to investigate why faculty recognize the importance of enhanced vision with loupes but are resistant to requiring the wearing of loupes in the educational setting.

Conclusion

Most responding dental hygiene programs do not require students or faculty to purchase or use loupes. The majority of respondents believe students should begin to wear loupes in their first year. Most respondents see advantages to loupes, but clinical policies on loupes do not appear to correlate with beliefs. Educational programs in dental hygiene seem slow to adopt and require the use of loupes. Current clinical policies on loupes should be reviewed to ensure graduates experience the potential ergonomic benefits magnification brings to clinical practice during their education.

Leslie McHaney Congdon, BSDH, MS, is an adjunct clinical faculty member at the Division of Dental Hygiene, Virginia Commonwealth University School of Dentistry. Susan Lynn Tolle, BSDH, MS, is a University Professor and Director of Clinical Affairs at the Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University. Michele Darby, BSDH, MS, is a University Professor and Eminent Scholar and Chair at the Gene W. Hirschfeld School of Dental Hygiene, Old Dominion University.

References

1. Morse TF, Michalak–Turcotte C, Atwood–Sanders M, et al. A Pilot Study of Hand and Arm Musculoskeletal Disorders in Dental Hygiene Students. *J Dent Hyg*. 2003;77:173–179.

2. Morse TF, Bruneau H, Michalak–Turcotte C, Sanders M, et al. Musculoskeletal disorders of the neck and shoulder in dental hygienists and dental hygiene students. *J Dent Hyg*. 2007;81(1):10.

3. Werner RA, Hamann C, Franzblau A, Rodgers PA. Prevalence of Carpal Tunnel Syndrome and Upper Extremity Tendonitis among Dental Hygienists. *J Dent Hyg*. 2002;76:126–132.

4. Hayes MJ, Cockrell D, Smith DT. A systemic review of musculoskeltal disorders among dental professionals. *Int J Dent Hyg*. 2009;7:159–165.

5. Lalumandier JA, McPhee SD. Prevalence and Risk Factors of Hand Problems and Carpal Tunnel Syndrome among Dental Hygienists. *J Dent Hyg*. 2001;75:130–133.

6. Anton D, Rosecrance J, Merlino L, Cook T. Prevalence of Musculoskeletal Symptoms and Carpal Tunnel Syndrome Among Dental Hygienists. *Am J Ind Med*. 2002;42:248–257.

7. Christensen JG. Magnification in dentistry: Useful tool or another gimmick? *JADA*. 2003;134(12)1647–1650.

8. Strassler HE, Syme SE, Serio F, Kaim JM. Enhanced visualization during dental practice using magnification systems. *Compend Contin Educ Dent*. 1998;9(6):595–598.

9. Sunell S, Rucker L. Surgical magnification in dental hygiene practice. *Int J Dent Hyg*. 2004;2(1):26–35.

10. James T, Gilmour AS. Magnifying loupes in modern dental practice: an update. *Dent Update*. 2010:37(9)633–636.

11. Syme SE, Fried JL, Strassler HE. Enhanced visualization using magnification systems. *J Dent Hyg*. 1997;71(5):202–206.

12. Nield–Gehrig JS. Fundamentals of periodontal instrumentation and advanced root instrumentation. 6th ed. Philadelphia, PA: Lippincott Williams & Wilkins. 2004. 9–21 p.

13. Yee T, Crawford L, Harber P. Work environment of dental hygienists. *J Occup Environ Med*. 2005;47(6):623–632.

14. van As G. Magnification and the alternatives for microdentistry. *Compend Contin Educ Dent*. 2001;22(11A):1008–1016.

15. Jarrett PM. Intraoperative magnification. *Microsurgery*. 2004;24(6):420–422.

16. Thomas J, Thomas FD. Dental hygienists' opinions about loupes in education. *J Dent Hyg*. 2007;81(4):82.

17. Maillet JP, Millar AM, Burke JM, Maillet MA, Maillet WA, Neish NR. Effect of magnification loupes on dental hygiene student posture. *J Dent Ed*. 2008;72(1):33–44.

18. Branson BG, Bray KK, Gadbury–Amyot C, et al. Effect of Magnification Lenses on Student Operator Posture. *J Dent Ed*. 2004;68(3):384–389.

19. Sunell S, Maschak L. Positioning for clinical dental hygiene care: preventing back, neck and shoulder pain. *Probe*. 1996:30(6);216–221.

20. Branson BG, Williams KB, Bray KK, McIlnay SL, Dickey D. Validity and reliability of a dental operator posture assessment instrument (PAI). *J Dent Hyg*. 2002;76(4):255–261.

21. Beach JC, DeBiase CB. Assessment of ergonomic education in dental hygiene curricula. *J Dent Ed*. 1998;62(6):421–425.

22. Meraner M, Nase JB. Magnification in dental practice and education: experience and attitudes of a dental school faculty. *J Dent Educ*. 2008:72(6):698–706.

23. Hagge MS. Use of surgical telescopes by senior dental students: a survey. *J Prosthod*. 2003;12(4):271–279.

24. Leknius C, Geissberger M. The effect of magnification on the performance of fixed prosthodontic procedures. *J Calif Dent Assoc*. 1995;23(12):66–70.

25. Donaldson ME, Knight GW, Guenzel PJ. The effect of magnification on student performance in pediatric operative dentistry. *J Dent Educ*. 1998;62(11):905–910.

26. American Dental Association Survey Center. 2008–09 Survey of allied dental education. ADA [Internet] 2009 [cited 2010 September]. Available from: http://www.ada.org/sections/professionalResources/pdfs/survey_allied.pdf