A Qualitative Look at Faculty Perspectives on Ergonomics in Dental Education

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Research Article

Abstract

Due to the high-risk nature of musculoskeletal disorder development in dentistry, ergonomic education and evaluation are needed in predoctoral programs. The purpose of this pilot study is to investigate perceptions of ergonomics within the School of Dentistry (SOD), current ergonomic clinical practices among third- and fourth-year dental students, and dental students' level of knowledge of ergonomics. The study was conducted utilizing an explanatory sequential mixed methods design to collect both quantitative and qualitative data. While the data collection occurred in three phases, this article will primarily focus on Phase III. The three phases of data collection were: Phase I consisted of a questionnaire distributed to all dental students; Phase II consisted of clinical observations of third- and fourth-year dental students' ergonomic postures during patient care, and Phase III consisted of SOD faculty focus groups to determine perceptions of ergonomic education with the predoctoral curriculum. Data revealed three overarching themes: (1) Didactic to clinical disconnect, (2) Elective impacts, and (3) A ready commitment. Phase I yielded a response rate of 84% (n=135). Phase I responses noted that 81.5% (n=110) of the dental students reported experiencing musculoskeletal pain. Ninety-three dental students reported receiving one or two lectures on ergonomics; however, 60% (n=27) failed to implement proper ergonomic postures while caring for patients in the clinical environment during Phase II. Phase III, revealed faculty support of ergonomic evaluation and correction among dental students. The results indicated a need to establish and implement an ergonomic evaluation and corrective program within the SOD.

Keywords: Ergonomics in dental education, MSDs among dental students, Ergonomics

1. Introduction

Musculoskeletal disorders (MSDs) can negatively impact one's career from loss of productivity, reduced working ability, chronic pain, and suffering, to premature retirement (Center for Disease Control [CDC], 2018; Ching et al., 2018; Katrova, 2017; McLaren & Parrott, 2018; Ng, Hayes, & Polster, 2016; World Health Organization [WHO], 2018). Musculoskeletal disorders are defined as
sprains, strains, and other connective tissue injuries that affect the muscles, joints, tendons, ligaments, cartilage, and spinal discs (Centers for Disease Control and Prevention [CDC], 2016; da Costa, 2008; Occupational Safety and Health Administration [OSHA], 2000, n.d.; Waters, 2010). Work-related musculoskeletal disorders (WMSDs) are a form of MSDs which develop or are exacerbated by working conditions or one’s job-related risk factors (Bernal et al., 2015; CDC, 2018; Cheng, Wong, Yu, & Ju, 2016; Mulimani et al., 2018; Waters, 2010). Work-related musculoskeletal disorders directly impact an individual’s productivity and can inhibit their ability to perform expected job duties which may result in job loss, or the inability to deliver optimal patient care (Ching et al., 2018; Gopinadh et al., 2013; Mulimani et al., 2018). The CDC reported WMSDs cause an annual $45-$54 billion financial burden. This financial burden includes: lost wages, decreased productivity, and compensation expenses (CDC, 2018). Common WMSDs include carpal tunnel syndrome (CTS), back pain and injury, and arthritis (CDC, 2018). Specifically, dental professionals within the United States report an annual loss of income of $41 million due to WMSDs (Mulimani et al., 2018). Based on disability claims by American Dental Association (ADA) members, the ADA reported one out of four dentists would be disabled before being eligible for retirement (ADA, 2014; Mulimani et al., 2018).

Research by Baadjou, Roussel, Verbunt, Smeets, & de Bie, (2016) and Yan et al., (2018) have found professions commonly affected by WMSDs include musicians, teachers, and administrative personnel. However, one of the largest classes of employees with potentially the most career-ending WMSDs are health care workers. Proper ergonomics are challenging for health care workers since many of them perform their duties in less than ideal positions and are many times in one place for long periods. Variations in patient populations make practicing ergonomic principles challenging for health care providers. Such patient variations include: (a) age, (b) size, and (c) patient compliance (Ching et al., 2018). Gopinadh et al. (2013) report 63 to 93% of dental providers are impacted with WMSDs. Work-related musculoskeletal disorders present themselves with a variety of symptoms, most commonly affecting dental professionals in the lower back, shoulders, neck, hands, and wrists (American Dental Association [ADA], 2008; Gopinath et al., 2013; Gupta, Bhat, Mohammed, Bansal, & Gupta, 2014). Lower back, shoulder, and neck pain experienced by dental professionals can be caused by sedentary seated positions and awkward torquing of the body (Gupta et al., 2014). Hand and wrist complications for dental professionals are potentially caused by the repetitive pinching motions and vibrations of the instruments (Gopinadh et al., 2013; Gupta et al., 2014).

Musculoskeletal disorders among dental professionals have been documented for decades. In 2014, Hayes, Smith, and Taylor reported MSDs as a global health issue, as well as a financial burden. The prevalence of MSDs among dental professionals potentially jeopardizes career retention and professional recruitment (Barry et al., 2017; Hayes, Smith, & Taylor, 2014). Research has shown that dental hygienists have been impacted by MSDs since the 1980s (Barry et al., 2017; Gravois & Stringer, 1980).

Working conditions frequently associated with the development of MSDs include sitting in awkward positions for extended periods, repetitive motions, use of slender instruments, and use of vibrating handpieces (ADA, 2004; Chaiklieng & Suggaravetsiri, 2015; Gopinadh et al., 2013; Mulimani et al., 2018). Although risk factors may lead to the development of MSDs, not every individual exposed to such factors is diagnosed with an MSD (ADA, 2004). Common risk factors for the development of MSDs are illustrated in Figure 1. Effective working ergonomics are vital to the practitioner’s ability to continue to practice dentistry, work efficiently, and be able to maintain a sustainable career. In addition to the physical positioning of dental professionals, ergonomics include the assessment of operatory lighting, instrument selection, and computer technology. The operatory layout, including the patient and operator chair positions, cabinetry location, and the flexibility of peripheral equipment, is essential to an ergonomically sound operatory (Gupta et al., 2014).
Dental hygiene programs have begun incorporating ergonomic education and training into their curricula as recommended by the American Dental Education Association (ADEA, 2016). To date, however, few schools are offering ergonomic content within their predoctoral dental curricula leading to the completion of a Doctor of Dental Surgery (DDS) or Doctor Medicine in Dentistry (DMD) (Commission on Dental Accreditation [CODA], 2019). Conversely, the limited ergonomic content currently within the predoctoral dental curriculum at an academic medical center indicates a potential gap in education on this topic.

The incorporation of adequate ergonomic content into the predoctoral dental curriculum could potentially reduce the chance that a dentist will experience chronic pain leading to the inability to deliver quality patient care, a decrease in productivity, a reduction of working hours, or early retirement (Alyahya, Algarzaie, Alsubeh, & Khounganian, 2018; El-sallamy, Atlam, Kabbash, El-fatah, & El-flaky, 2017; Gopinadh et al., 2013; Moodley, Naidoo, & van Wyk, 2018; Ohlendorf et al., 2017). Also, the daily practice of proper ergonomics reduces the risk of the development of WMSDs, which can increase the chances of unbearable pain, injury, increased fatigue, and in some instances suicide (Garcia, Wajngarten, & Campos, 2018; McLaren & Parrott, 2018).

Due to the increasing prevalence of MSDs among dental providers, ergonomic content could prove to be a beneficial component to current didactic and clinical components; however, the majority of dental schools in the United States do not include ergonomics as part of the predoctoral curricula (Katrova, 2017; McLaren & Parrott, 2018). Considering the prevalence of dental professionals and dental students' reports of pain or discomfort, studies indicate that the incorporation of ergonomics into the predoctoral education curricula would significantly benefit dental students (El-sallamy et al., 2017; Gopinadh, 2013; Katrova, 2017; Shaik, 2015).

Although limited predoctoral dental curricula provide ergonomic education, they often fail to emphasize the importance of proper ergonomic utilization by limiting the amount of student assessment and accountability. (McLaren & Parrott, 2018; Ng et al., 2016). In 2017, El-Sallamy et al. found that dental students self-reported their partial understanding of ergonomics and how it applies to dentistry, but strongly felt it should be incorporated into the dental curriculum. El-Sallamy et al. (2017) and Karibasappa, Sujatha, & Rajeshwari (2014) report students had some knowledge of proper working positions; however, they failed to demonstrate corresponding
behaviors while providing dental services. The lack of clinical adaptation to ergonomically friendly positions is thought to be attributed to the combined pressures of classroom education and clinical responsibilities (El-sallamy et al., 2017).

The purpose of Phase III of this pilot study is to explore the perceptions of faculty regarding ergonomics and the incorporation of ergonomics into the predoctoral curriculum in addition to answering the following questions:

1. What are the perceptions regarding ergonomics within the School of Dentistry?
2. What are faculty perceptions of educating dental students on proper ergonomics?

2. Literature Review

The profession of dentistry is physically demanding, therefore, the implementation of ergonomics into a dentist’s daily practice can diminish their vulnerability to the development of musculoskeletal disorders (MSDs) (Dable et al., 2014; Decharat, Phethuayluk & Maneelok, 2016; Pirvu, Patrascu, Pirvu, & Ionescu, 2014). The practice of dentistry is highly focused on prevention, however, there is limited emphasis on the prevention of MSDs within the predoctoral dental curricula.

Ergonomics in dentistry applies to the operatory design and layout, operator chair, instrument selection, and patient positioning (Valachi, 2008). Several studies have found that dentists commonly experience musculoskeletal pain in the lower back, neck, and shoulders (Gopinadh et al., 2013; Kalappa & Shankar, 2017; El-sallamy et al., 2017; Lin et al., 2012). Approximately two out of three dental professionals and 70% of dental students reported experiencing some form of musculoskeletal pain (Katrova, 2017; Valachi, 2008). Incorporating ergonomic education in conjunction with implementation strategies, equipment selection, and modification alternatives could alleviate musculoskeletal pain and potentially prevent MSDs (Katrova, 2017; Shaik, 2015).

An ergonomically friendly operatory or workstation is designed to allow an individual to efficiently perform their job duties without having to physically force themselves to fit the workspace (Gopinadh et al., 2013; Shaik, 2015; Waters, 2010). Although musculoskeletal pain may not show up initially, an ergonomically designed operatory is an initial step in improving one’s musculoskeletal health as well as improving work efficiency and productivity (Ahearn, Sanders, & Turcotte, 2010; Shaik, 2015). Ideally, treatment areas should be designed for ease of dental procedures as well as movement around the patient (Ahearn et al., 2010).

A recent study conducted titled *Survey of Current Issues in Dentistry* by the ADA, aimed to capture topics pertinent to dental professionals. The *Survey of Current Issues in Dentistry* was initially mailed to 5,775 privately practicing dentists in the United States who graduated from a CODA-accredited dental school in the United States. Multiple follow-up notices were mailed to non-respondents in the following months as well as a final follow-up phone call. The response rate totaled 40.2% (2,131 respondents) which can be attributed to an average of 45 minutes to complete the survey. Fifty-seven percent (n=1,215) of dentists reported regularly experiencing pain in one region of their body (ADA, 2008). These findings are lower than the previously discussed reports of musculoskeletal pain experienced by Turkish dentists (80%) (Koyuncu & Karicioglu, 2018).

Alghadir, Zafar, & Iqbal (2015) distributed a questionnaire to 225 Saudi Dental Association (SDA) members, of which 146 were returned. The survey captured necessary demographic data as well as general medical history and pre-existing experiences with any WRMDs before and after joining the dental association. Prior to entering the dental profession, 86% (n=126) reported no musculoskeletal pain; whereas 85% (n=124) did report experiencing musculoskeletal pain after entering the dental profession (Alghadir et al., 2015). Seventy percent (n=102) of the SDA members had practiced less than five years and reported musculoskeletal pain in the lower back, neck, shoulders, and hands (Alghadir et al., 2015).
In 2016, Al-Mohrej, AlShaalan, Al-Bani, Masuadi, & Almodaimegh conducted a cross-sectional study among dentists in the capital city of Saudi Arabia, Riyadh. Dentists who had practiced less than one year or had any preexisting orthopedic trauma including congenital deformities of the neck, back, or upper extremities were excluded from this study. The questionnaire was distributed to 224 dentists practicing in both a hospital and private polyclinic settings, a medical facility that offers three or more medical specialties (Al-Mohrej, AlShaalan, Al-Bani, Masuadi, & Almodaimegh, 2016; Bureau of Experts at the Council of Ministers, 2011). Researchers translated the standard English version of the NMQ into Arabic for the population of this study (Al-Mohrej et al., 2016). This questionnaire was divided into multiple parts for a total of 98 questions. The first section was designed to collect basic demographic data including health history and exercise regime. Three other sections were aimed specifically at musculoskeletal pain of the neck, upper extremities, and lower back. The final section captured the interval, incidence, and intensity of the pain experienced. Of the 224 invited participants, 204 responses led researchers to attain a 91% response rate. Ninety percent of the dentists surveyed reported experiencing musculoskeletal pain. A vast majority, 68.1% (n=139), reported pain in the lower back followed by neck, shoulder, and hand and wrist pain as 34.3% (n=70), 34.3% (n=70), and 22.1% (n=45) respectively. The pain reported by 86.5% (n=176) of the dentists had been ongoing for four weeks or more; however, 3.8% (n=7) sought medical attention for this pain. The severity of musculoskeletal pain among dentists widely varied from mild 28.3% (n=58) to moderate 7.4% (n=15); however, severe pain was experienced by 64.3% (n=131). This pain severity led 12% (n=24) of the dentists to take sick leave during the past year due to musculoskeletal pain (Al-Mohrej, AlShaalan, Al-Bani, Masuadi, & Almodaimegh, 2016). Ninety percent of dentists reported musculoskeletal pain in the lower back, neck, and shoulders, increasing concerns regarding their sustainability within the dental profession (Alghadir et al., 2015; Al-Mohrej et al., 2016).

Gopinadh et al. (2013) conducted a cross-sectional study to ascertain the prevalence of MSDs and ergonomics among general dentists and specialists. The questionnaire captured data regarding the participant’s experience of musculoskeletal pain, awareness of correct working posture, and work habits. A vast majority of the participants, 73.9% (n=289), suffered from musculoskeletal pain. Musculoskeletal neck pain was reported by 31.7% (n=124) of the assessed population followed by 29.2% (n=114) experiencing back pain (Gopinadh et al., 2013).

Kalappa and Shankar (2017) requested participation from 248 dentists in Bangalore, India to assess the prevalence of MSDs, work habits, and general awareness of MSDs. The work habits included years of practice, workday hours, specialists, two or four-handed dentistry, and exercise routines. Kalappa and Shankar (2017) reported 90.32% (n=224) of the participants experienced MSDs in the year prior to the study. Among the assessed population, musculoskeletal pain was experienced in the back, 51.61% (n=128), neck, 19.35% (n=48), and shoulder, 32.25% (n=80).

3. Education of Musculoskeletal Disorders and Ergonomics

Adequate knowledge of proper ergonomics is frequently recommended to aid in the reduction of MSDs (El-sallamy et al., 2017; Khan & Chew, 2013; McLaren & Parrott, 2018; Phebus, 2015). Ninety percent of dental students report not receiving postural education as part of their undergraduate curriculum (McLaren & Parrott, 2018). Student reports of musculoskeletal pain or discomfort increased significantly through their years in dental school (Katrova, 2017; Vijay & Ide, 2016). This increase in musculoskeletal pain has heightened the awareness of the need for ergonomic education within predoctoral curricula (Katrova, 2017). In 2015, Safi et al. surveyed 46 dentists with a mean age of 40.8 years to determine topics in which further education is needed. Ninety-three percent (n=42) of the participants felt dentists need further instruction on dental ergonomics and occupational health (Safi et al., 2015).

A cross-sectional study was performed among 479 third- and fourth-year dental students at Tanta University to assess knowledge, attitude, and practice regarding ergonomics (El-sallamy et al.,
Data were collected from dental students during a three-month period starting in January 2016. Students' ergonomic knowledge was assessed through a self-reported questionnaire whereas attitude towards ergonomic practices was assessed on a 5-point Likert scale. El-sallamy et al. (2017) and Garcia et al. (2018) reported students to possess good ergonomic knowledge but often failed to implement the ergonomic practices while delivering patient care and often lacked an understanding of their errors. The failure of students to implement proper ergonomic practices can be attributed to the failure of faculty accountability, lack of attention, forgetfulness, and failure to develop the habit (El-sallamy et al., 2017; Garcia, Gottardello, Wajngarten, Presoto, & Campos, 2016). More than 80% (n=383) of dental students surveyed reflected a positive outlook on studying ergonomics and felt ergonomics should be included in dental curricula (El-sallamy et al., 2017). In the assessment of student attitude toward ergonomics, no significant association was determined among attitude and practice, as over 90% (n=431) of students demonstrated a positive attitude and fair knowledge of ergonomics; however, they still failed to implement proper ergonomic techniques (El-sallamy et al., 2017).

To capture the prevalence of MSDs among dental students, Vijay and Ide (2016) conducted a cross-sectional study among 398 dental students enrolled in a dental school in the United Kingdom. Participants were asked to complete a modified Nordic Back Pain questionnaire to capture any musculoskeletal pain in the upper back, lower back, and neck region. The dental students were asked to indicate their 'average pain intensity,' which was reflected as a visual analog scale (VAS) score (Vijay & Ide, 2016). The VAS is a pain scale consisting of a straight line with reference points indicating extreme limits: no pain or unbearable pain (Haefeli & Elfering, 2006). Of the 398 participants, 79% (n=314) of dental students experienced musculoskeletal pain in the back and neck, and more than half reported experiencing the pain for longer than one month. The dental students' reports of pain were consistent with results from previous studies (Vijay & Ide, 2016).

4. Methods and Materials
4.1. Research Design
This investigation was carried out in three phases to investigate the ergonomic practices and perceptions at a dental school housed at one academic medical center. An explanatory sequential mixed methods study design was utilized to collect quantitative and qualitative data. The differing methodologies resulting in a triangulation of the data helped to gain a better understanding of the ergonomic practices among dental students, dental students’ level of knowledge of ergonomics and MSDs, and the SOD administration and faculty perceptions of educating dental students on proper ergonomic practice. Specifically, Phase III utilized focus groups with SOD faculty and administration guided by investigative questions developed from data collected during Phase I (student questionnaire).

4.2. Population
Phase III participants included administration and SOD faculty. Administrative personnel included department chairs, Assistant Dean of Clinical Affairs, Associate Dean of Academic Affairs, Associate Dean of Student Affairs, and Dean of the School of Dentistry. School of Dentistry faculty range in rank from instructor to professor. The SOD employs 41 full-time faculty and 27 part-time faculty. However, part-time faculty were excluded from the invitation due to limited availability for participation. There was a 21% (n=9) participation rate.

4.3. Data Collection
Phase III participants were asked to complete a brief demographic form. The demographic form was used to collect (a) age, (b) gender, (c) years in private practice versus years in academia, and (d) comfort level of assisting dental students with ergonomically correct working postures. In
Phase III, a semi-structured interview guide was utilized to assess the perceptions of ergonomics among dental school faculty and administration. Phase III aimed to capture data reflecting the SOD faculty’s personal experiences of musculoskeletal pain and their perceptions of incorporating ergonomics into the predoctoral curriculum. Focus groups were recorded using the Swivl® research recorder as well as a handheld voice recorder. Each focus group session consisted of three participants, varying in rank and position. The focus groups were conducted in a private conference room within the SOD. Focus groups were offered at multiple different dates and times to increase participation and ensure a maximum variation of the sample population.

4.4. Data Analysis
To analyze the data collected through Phase III focus groups, a coding process was utilized to determine any common themes that exist among faculty’s perceptions of ergonomics and their personal experiences with musculoskeletal pain. The investigator and peer coder utilized a scissor-and-sort technique to analyze the data. The investigator and peer coder independently applied the scissor-and-sort technique to perform thematic analysis based on participant responses and comments. Immediately following each focus group session, the investigator and assistant note-taker debriefed to review the observational data collected and initiated the coding process through discussion. A peer coder was also provided the transcripts for thematic analysis and to authenticate findings from the SOD faculty focus groups.

5. Results
The qualitative data collected for this study were intended to explain the perception of ergonomics among SOD faculty, administrators, and students. In applying the scissor-and-sort technique of thematic analysis, the investigator and peer coder identified three overarching themes. The three overarching themes are identified in Figure 2 below.

*Figure 2. Themes: Ergonomic education and perceptions at UMMC SOD.*
5.1. Theme One: Didactic to Clinical Disconnect

Overall, focus group participants indicated a clear disconnect from didactic to clinical education regarding ergonomics and ergonomic postures. Unanimously, faculty participants indicated a strong sense of importance regarding educating dental students on proper ergonomic postures while rendering patient care. Many expressed the impact musculoskeletal pain or MSDs has had on their career.

“I’ve had three neck surgeries and eight hand surgeries. I sold my practice sooner than I would have" (Participant B).

“I was in constant musculoskeletal pain. Lower and middle back pain and sciatica was part of my decision to come to academia" (Participant G).

“MSDs and dentistry definitely go hand in hand. I have had one hand surgery already” (Participant A).

The majority of faculty reported that ergonomic education should carry over from the classroom to the clinical setting. Focus group responses indicated a disconnect between didactic education to clinical implementation. A few participants shared personal experiences regarding ergonomics within their predoctoral curriculum.

“We had a four-handed dentistry course which was focused on equipment, workstation, and instrument transfer. We were given slight feedback on posture, elbows, wrist, fingers, etc.” (Participant G).

“There was heavy ergonomic content with the utilization of four-handed dentistry and the use of dental assistants. We [dental students] were graded more on maneuvers and how we worked with the assistant and the passing of instruments” (Participant H).

“When I was in dental school, we had a course which focused heavily on ergonomics and posture. The course was taught each year of dental school. It was modified as the students progressed through dental school” (Participant I).

“Students are trying to learn a skill [dentistry] – ergonomics should be part of that skill” (Participant B).

Through the faculty focus groups, participants expressed the importance of students being held accountable for their ergonomics beginning early in their dental school education. Furthermore, they highlighted the need for additional faculty education regarding student instruction and evaluation of ergonomics in both didactic and clinical settings.

“It is there in some courses, but it is not enforced throughout the curriculum and especially not in the clinic” (Participant A).

“That’s [ergonomic assessment] where we are falling short – we need to figure this out” (Participant G).

“If it’s not part of the rubric, they [dental students] have a tendency to ignore it” (Participant H).

“Some faculty who have had several surgeries are more apt to say something to dental students, but others won’t. Don’t correct them [dental students] in front of a patient. They [dental students] don’t like to feel put down. Would love to see how our [dental] students change and evolve if we started to incorporate this [ergonomics] into the grade sheet” (Participant B).
“Some faculty do correct it [ergonomics], but not all. Students know who corrects them; they change their posture when certain faculty are around” (Participant F).

“They [dental students] are comfortable with correcting them when the students know you show genuine concern” (Participant A).

The majority of the faculty participants mentioned the early implementation of proper ergonomic practices and suggested starting within the preclinical activities. Based on faculty experiences, the ergonomic lectures provided to dental students often provide minimal exposure and lack follow-up within clinical settings.

“We can preach it all day long, but if [we] see them in [the SIM] lab or in the clinic with poor posture go ahead and correct it. We have four years with them [dental students]; it is our responsibility to teach them and hold them accountable” (Participant E).

“Current dental students get an ergonomic lecture in two different courses within their first year of dental school; however, it would be beneficial to have this in SIM lab instead of just lecture” (Participant H).

According to the current Commission on Dental Accreditation (CODA) document, no accreditation standard exists which requires ergonomic education within the predoctoral curriculum (CODA, 2019). It was noted that students have didactic exposure to lectures addressing musculoskeletal disorders and ergonomic postures; however, they lack implementation of proper ergonomic postures when rendering patient care. Curriculum content must not be viewed in “silos,” but rather clinical education enforces didactic content (Skylar, 2018). Research has shown that traditional forms of lecturing have been identified as the least effective method of knowledge acquisition (Khan, Chikte, & Omar, 2013; Krueger et al., 2004). Effective clinical education begins in the classroom followed by clinical implementation. Students often overlook the implementation of didactic content when beginning clinical practices. Since active learning is a guided process and occurs within the clinical setting, clinical faculty facilitate this deeply rooted approach to learning through critically assessing and correcting student performances (Khan et al., 2013).

5.2. Theme Two: Elective Impacts
The second overarching theme encompasses the benefits and consequences of the implementation of proper ergonomic practices. Research has shown that students involved in clinical education often honed in on the procedure to be completed (Khan et al., 2013; Biggs & Tang, 2011). Multiple faculty mentioned students as well as dentists focused on the task at hand rather than the long-term impact.

“Students are indestructible as youth. They take it as you [faculty] are being meddlesome or you are being knaggy. I still do it [correct their posture] but not enough. If they were more interested, I’d do it more” (Participant F).

"Dentists and students are very task-oriented. You’re thinking you just have a minute, and you’ll be done with this procedure instead of standing up and taking a break. This task has to get completed. Hygiene needs me, [and] I have to keep going, I have to finish this, I don’t have time to worry about me – I’ll be ok, I’ll make it” (Participant A).
5.3. Theme Three: A Ready Commitment
The third and final theme emerging from the data reflected a need for a multifactorial, collaborative, culture change that is convenient and collaborative to provide continual growth towards ergonomic competence among dental students. Based on faculty responses, there is an overwhelming concern for the lack of ergonomic evaluation throughout the clinical experiences. Early ergonomic intervention and prevention practices improve performances leading to greater productivity and career longevity (Jodalli, Kurana, Ragher, Khed, & Prabhu, 2015). Research has shown that assessment drives learning (Khan et al., 2013). The majority of the faculty participants felt ergonomic evaluations should be included as part of the students’ grades; however, there is limited faculty that currently correct improper postures.

“We [faculty] should help them to position things to allow them to work efficiently; their cart, materials, instruments, chair positions” (Participant G).

“Ergonomic evaluations need to be practical – an assessment component, someone walks around evaluating their ergonomics during procedures” (Participant H).

“We [dentists] are responsible for assistants’ and hygienists’ career happiness and ergonomics. We [dentists] need to help improve their career longevity and happiness in the profession. If [dental] students realize that with all this good training, but you can’t follow through with 25 or 35 years of service to fellow man, then you have defeated the purpose of what you’re about here” (Participant F).

“I have had multiple surgeries; I don’t want you [dental student] to have any. Shows the students there’s genuine concern for them and their career longevity” (Participant B).

Based on student reports of musculoskeletal pain from Phase I, 81.5% (n=110) of dental students at UMMC reported experiencing this type of pain; the majority (60%; n=27) of dental students exhibiting high-risk ergonomic postures, and the faculty concerned of inadequate ergonomic clinical postures leads the investigator to believe that the establishment of an ergonomic education and evaluation system is warranted.

6. Discussion
6.1. A Paradigm Shift
Curricular changes occurring, regardless of education level, must be done through a process that includes planning, developing, implementing, and evaluating (Albilehi, Han, Desmidt, 2012/2013; Al-Madi, Al-Shiddi, Al-Saleh, & Latif, 2018; Connecticut State Board of Education, n.d.; Diamond, 2008). Based on the findings of this pilot study, a culture change that is a convenient and collaborative effort among faculty and students is essential in enhancing ergonomic education and practices. Part of this culture change begins with educating the faculty and incorporating ergonomic assessments into portions of the existing predoctoral curriculum. Another aspect of this culture change is a collaboration among various programs or schools within the academic medical center to assist in providing ergonomic educational opportunities to the dental faculty and students. During the focus groups, faculty expressed ideas of incorporating guest lecturers from physical therapy (PT), occupational therapy (OT), seasoned dental professionals, and specialists in which treat those suffering from MSDs. A collaborative effort with other health care professionals provides the needed support for all stages of the curriculum development process and alleviates the expended time, energy, and resources that would be necessary to accomplish the transition independently. This collaboration creates a shared responsibility as it provides a learning opportunity for all students and faculty involved. The dental faculty can observe and learn from the PT and OT faculty and students as they assess, guide, and correct the working
postures of dental students, ultimately increasing the dental students’ awareness of working under ergonomically friendly postures.

This study explored the perceptions of faculty and administration regarding the incorporation of ergonomics within the predoctoral curriculum. This phase of the study aimed to answer the following questions: 1) What are the perceptions regarding ergonomics within the School of Dentistry? and 2) What are faculty perceptions of educating dental students on proper ergonomics?

The perceptions of ergonomic education were revealed through the faculty focus groups. Faculty repeatedly expressed their concern for the lack of ergonomic evaluation within the clinical setting. Unanimously, faculty expressed the lack of accountability in assessing and correcting ergonomic postures in the clinical setting.

7. Conclusion
Dental providers are exposed to occupational risks daily due to awkward body positions, visual acuity, and repetitive motions (Phebus, 2015). A direct correlation has been established between poor ergonomic practices and the development of MSDs. Musculoskeletal disorders have plagued the dental profession for many years. Literature reports that a majority of dental professionals suffer from some form of WMSDs, which can negatively impact the dental workforce (Al-Mohrej et al., 2016; Hayes, Cockrell, & Smith, 2009; Kalappa & Shankar, 2017; Ng et al., 2016; & Valachi, 2008). There is evidence to support the development of MSDs among dental students. Therefore, the need has been identified to improve ergonomic education and practice early within the predoctoral curriculum. Studies conducted show the overwhelming need as well as the desire for ergonomics to become part of the dental education curricula (El-sallamy et al., 2017; Katrova, 2017; Phebus, 2015; Safi et al., 2015; Vijay & Ide, 2016). During Phase III, some faculty reported a tendency to correct ergonomic postures, whereas others reported feeling uncomfortable doing so. The reports of musculoskeletal pain and concerns from faculty as well as the literature support a necessity of ergonomic awareness within the predoctoral curriculum.

8. Limitations
While the results of this pilot study provided insight into the perceptions of ergonomics within UMMC SOD, some limitations were identified. The investigator’s role as a faculty member could be considered a limitation. Faculty focus group participants could have felt a tendency to respond with answers they believed the investigator desired. Although data saturation was met, extending this study to other dental schools would allow greater insights from a more diverse faculty population securing a maximum variation of the sample population.

9. Further Research
This pilot study is intended to be the starting point for future research and to provide initial findings pertaining to faculty and student ergonomic perceptions as well as ergonomic practices among dental students. Data collected from this study can be used to support the addition of ergonomic education at the beginning of dental curricula. In addition to early implementation, continual implementation in didactic and clinic education is critical.

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