

Understanding the Impact of Ergonomic Practices on Musculoskeletal-Related Symptoms and Emotional Wellness in Craniofacial Surgeons

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Background: A systematic review conducted in 2017 found that Musculoskeletal (MSK) injuries were prevalent among surgeons. Few studies have assessed the role that poor surgical ergonomic practices have had in the development of MSK injuries in plastic and reconstructive surgery (PRS), and fewer specifically in craniofacial surgeons. The impact that MSK injuries have on the emotional well-being of craniofacial surgeons is also not well understood.

Methods: A branched logic survey with a maximum of 35 questions pertaining to surgical practices, MSK injuries, and emotional well-being was distributed to all active attending physicians who were members of the American Society of Maxillofacial Surgeons (ASMS). The responses were divided into 2 groups, surgeons who reported developing MSK injuries or physical discomfort and those who denied developing MSK injuries or physical discomfort. Data analysis was performed to determine which factors contributed to the incidence of MSK

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injury and the emotional impact that these injuries had on craniofacial surgeons.

Results: A total of 82 active craniofacial surgeons completed responses to the survey for an overall response rate of 16.6%. Of these respondents, 65.9% (n = 54) suffered MSK injuries or physical discomfort, and 53.7% (29/54) reported difficulty with either falling asleep or staying asleep because of these symptoms within the last year. Both male and female respondents reported experiencing some level of anxiety or depression because of their MSK injuries.

Conclusion: The impact of a MSK injury may impact both physical and emotional wellness of craniofacial surgeons. This study found that a high percentage of craniofacial surgeons have MSK-injuries whereas some have reported a negative impact on their sleep and emotional well-being.

Key Words: Craniofacial, emotional, ergonomic, musculoskeletal, plastic, sleep, surgeon, surgery, well-being

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usculoskeletal (MSK) injuries are unfortunately common and negatively impact the longevity of a surgeon's operative career and the level of care provided to patients.¹ For this reason, the American College of Surgeons has published surgical ergonomics recommendations to reduce physical and mental strain during surgery to ensure optimal patient safety and outcomes.² Awareness of these recommendations, and knowledge of the prevalence of MSK injuries is paramount to improve surgeon quality of life and career longevity.³ A 2018 survey of 865 plastic surgeons across the United States, Canada, and Norway found that 78.3% of respondents had musculoskeletal symptoms and 6.7% of all respondents required surgical intervention for their symptoms.⁴ Few studies have assessed the role that poor surgical ergonomic practices have had in the development of MSK injuries in plastic and reconstructive surgery (PRS), and fewer in craniofacial surgeons.⁴⁻⁸ Thus, we have identified a paucity of studies in the literature specifically addressing intraoperative ergonomic practices to reduce the incidence of MSK injuries in craniofacial surgeons. Furthermore, this study attempts to address the impact that MSK injuries can have on the emotional well-being of craniofacial surgeons.

METHODS

Survey

After Institutional Review Board exemption, a survey was distributed through email to physician members of the Ameri-

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can Society of Maxillofacial Surgeons (ASMS). A branched logic survey was created using SurveyMonkey with a maximum of 35 questions that pertained to surgical practices, MSK injuries, and emotional well-being (see digital content). A brief description of the rationale, methods, and duration of the study was included in the email. The survey remained open from June 1 to August 30 of 2022, with 4 follow-up emails sent during this 90-day period. Survey responses were descriptive in nature. All data collected were anonymous.

Analysis

The responses were divided into 2 groups—surgeons who reported suffering from MSK injuries or physical discomfort and those who did not. For normally distributed continuous variables, the mean and standard deviation are reported. Independent samples *t* tests were used to test the differences in variables between the 2 groups. For the rest of the continuous variables that were not normally distributed, we reported the median and interquartile range (IQR). A non-parametric Mann-Whitney *U* test was utilized to check for differences between the 2 groups. For all the categorical variables, Pearson's chi-square test was used to investigate differences between the 2 groups. The supplemental tables report the test statistics and 2-sided *p*-values. All analyses were conducted using SPSS 28.0 (IBM Corp) and are considered statistically significant when P < 0.05.

RESULTS

Demographics

The survey was sent to 495 craniofacial surgeons who are active members of the ASMS. A total of 82 attending physicians completed responses to the survey for an overall response rate of 16.6%. Among the 82 completed responses, 76.8% (n = 63) were male and 23.2% (n = 19) were female. A total of 65.8% (n = 54) suffered MSK injuries or physical discomfort. Among the respondents, 35.4% were younger than 44 years (n = 29), 14.6% were 45 to 54 years old (n = 12), 18.3% were 55 to 64 years old (n = 15) and 31.7% were older than 64 years (n = 26). Practice design was primarily fully academic (43.9%), followed by hospital-employed (30.5%) and private practice (25.5%).

Characteristics and Ergonomic Practices in Injured Versus Uninjured Surgeons

From Supplemental Tables 1, Supplemental Digital Content 1, http://links.lww.com/SCS/H82, 2, Supplemental Digital Content 2, http://links.lww.com/SCS/H83, and 3, Supplemental Digital Content 3, http://links.lww.com/SCS/H84, the demographics, characteristics, and intraoperative ergonomic practices of surgeons who developed MSK injuries did not differ from those who did not have injuries. Both groups have similar baseline median scores for how many days they operate weekly (P=1.0), physical activity (P=0.803), and willingness to modify their practice based on literature findings (P = 0.590). Supplemental Table 4, Supplemental Digital Content 4, http://links. lww.com/SCS/H85 reports the impact, location, and nature of MSK symptoms or injuries. Among those who reported injury, 20.7% (n = 11) had to reduce their surgical workload due to the injury, and 26.4% (n = 14) had to take time off work due to the injury and physical discomfort. Lastly, 20.7% (n=11) underwent surgery due to the injury. The most common body parts affected were the neck (80.8%), shoulders (57.7%), and lower back (51.9%). The impact of these symptoms is reported to be most common immediately after performing surgery (29.4%),

followed by later that day after surgery (25.5%), persistently throughout the day (25.5%), and only during surgery (19.6%). Cleft palate surgeries were reported to be most likely to cause physical discomfort symptoms at 68%. The most prevalent reported symptoms were pain (88.2%), stiffness (64.7%), fatigue (52.9%), numbness (27.5%), and others (5.9%). From Supplemental Table 5, Supplemental Digital Content 5, http://links. lww.com/SCS/H86, the mean for the answer to the question, "How severe is your joint or muscle pain and/or stiffness overall during the day in the last year" is $3.92 (\pm 2.08)$ points out of 10. Although, on average, these symptoms interfered with their work or daily routine 2.83 (\pm 2.46) points out of 10. The mean score for how much these joint or muscle symptoms interfered with social activities is $3.09 (\pm 2.63)$ points out of 10. The median reported score for feeling anxious or depressed because of joint or muscle symptoms in the last year was 1.0(0.0-4.0) point out of 10.

Emotional Impact of MSK Injuries

A total of 53.7% (29/54) of surgeons who reported suffering from MSK-related injuries or physical discomfort also reported that they had trouble with either falling asleep or staying asleep because of these symptoms in the last year. The median reported score was 2.0 (1.0–3.0) nights per week. There was no significant difference in the emotional well-being of male and female surgeons who suffered an MSK injury. However, female surgeons report slightly higher baseline scores for feeling anxious or depressed because of joint or MSK symptoms (median = 2.0, [IQR:0–5.0]) compared with males (median = 1.0, [IQR:0–4.0]). Females also report a slightly higher baseline score for trouble falling asleep or staying asleep because of joint or muscle symptoms (median = 2.0, [IQR:1.25–3.5]) compared with males (median = 1.0, [IQR:1.0–3.0]).

Multivariate Regression

A binary logistic regression was created to predict factors that could alleviate and aggravate MSK injuries in craniofacial surgeons (Supplemental Table 6, Supplemental Digital Content 6, http://links.lww.com/SCS/H87). The outcome variable of interest was if the surgeon developed an MSK injury. The independent variables included were age, sex, number of weekly operating days, practice design, table height adjustment before surgery, help from the first assistant, anti-fatigue mats, microscope use, loupe use, type of lenses, headlamp use, orthotic shoes, orthotic insoles, and compression socks. The results from the multivariate analysis did not find any statistically significant results.

DISCUSSION

The intent of this study was to further define ergonomic practices as they relate to the prevalence of MSK injury and to assess the emotional impact of these injuries on craniofacial surgeons. A previous study found that unique risk factors for MSK injury in open surgical procedures included, but was not limited to, loupes, headlights, and microscopes.^{1,7} This differed from our study that found no significant relationship between the prevalence of MSK injury and the use of loupes, headlights, microscopes, or the adjustment of table height prior at the beginning the operation. Consistent with our findings, a recent study investigating work-related MSK injuries in plastic surgeons in the United States, Canada, and Norway, found that although Norwegian surgeons perform the highest volumes of microsurgery, they reported the lowest rates of MSK symptoms relative to their American and Canadian peers.⁴ The authors stated that although this finding may be counter-intuitive, it is

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consistent with the comprehensive dental literature that has found no evidence that the use of loupes increases neck discomfort.⁴ The results of our study indicated that there was not one particular predictive variable that alleviated or aggravated MSK injuries or dictated the overall prevalence of MSK injuries.

Our study also attempted to assess the impact of a surgeon's prioritization of personal comfort as it relates to MSK injury by assessing interventions such as table height, patient positioning, operative schedule demand, and adequate assistance from a first assistant. Although our study did not find a statistically significant relationship between these variables and MSK injuries, another study designed to assess the implementation of intraoperative microbreaks found that microbreaks improved selfreported physical performance and mental focus and reduced body part discomfort, without significantly increasing surgical duration.⁹ In this study, surgeons were prompted to take 1.5 to 2-minute microbreaks in which they performed guided exercises within the sterile field at 20-40-minute intervals.⁹ Our study indicates that change may be impactful without the addition of equipment or observers in the OR, but did not specifically survey the frequency of intraoperative breaks that respondents took. In another study by Koshy, ergonomic training and microbreaks were effective in reducing symptoms in 69.9% of surgeons.10

Our study reported that 65.9% of surgeons have an MSK injury or physical discomfort. This is consistent with a 2010 study that found that of the 339 plastic surgeons queried, 81.5% were currently experiencing symptoms related to MSK conditions.¹¹ The most prevalent conditions mentioned by respondents were muscle strain, vision changes, cervical pain, lumbar pain, and shoulder arthritis/bursitis.¹¹ When juxtaposed with other labor-intensive populations (i.e., factory workers, etc.), the rates of self-reported injury were highest amongst plastic surgeons, however the sampled population in that study was younger than the national general surgery workforce and therefore may underestimate the incidence of occupational injury.¹¹ Contradicting this assumption, a survey of 104 PRS residents found that, while 94% of respondents experienced MSK pain in the operating room (OR), increasing postgraduate year (PGY) and independent versus integrated status had no correlation with pain, suggesting that symptoms began early in training.⁵ Our findings did not yield a temporal relationship between the incidence of MSK injury and surgeon age, implying that surgeons of any age are susceptible to suffering an MSK injury.

The most frequently cited limitations in the surgical ergonomics literature were the subjective nature of surveys and questionnaires, recall bias, and increased likelihood of those who are suffering from MSK pain to respond to the survey. Recall bias makes it difficult to discern whether a surgeon's MSK symptoms are a result of improper intraoperative ergonomics or a source outside of the OR. We attempted to account for this by asking our respondents when they experienced their symptoms relative to the time they spent operating (Supplemental Table 4, Supplemental Digital Content 4, http://links. lww.com/SCS/H85). We found that respondents most frequently experienced exacerbation of symptoms immediately after operating. Kokosis et al⁵ proposed a solution to this; utilizing an independent intraoperative observer to document the ergonomic practices of the surgeon and assess the relationship of these findings with MSK injuries. However, most objective measures, this proposal included, are cumbersome and not practically implemented in the OR.¹ Alternatively, a future study that is designed to take place in a surgical simulation setting with an independent observer, and pre/post temporal assessment of reported MSK symptoms, may make for a feasible approach to identify alleviating and aggravating intraoperative techniques.

Our study found that over half of the surgeons who reported having an MSK injury have experienced difficulty falling asleep or staying asleep. Both male and female respondents who suffered from MSK injuries reported some level of anxiety and depression because of their injury. Although we did not find statistically significant differences, we found that both male and female surgeons who suffered MSK injuries felt anxious, depressed, and experienced sleep disturbances because of their injuries. Previous literature has yet to define the relationship that MSK injuries may have on emotional well-being and sleep. This also presents an important opportunity for further research with a higher-powered study which may further elucidate the impact that developing an MSK injury and managing the symptoms may have on the emotional well-being and sleep of surgeons.

This study is not without limitations. Our survey includes respondents of the ASMS, which includes, but is limited to, a subset of surgeons who operate primarily in the head and neck region. We recognize this as a limitation of our study as this may not be representative of all surgeons. We also recognize that our study was underpowered with a response rate of 16.6% being lower than some of the other published survey-based studies. The subjective nature of responses to surveys is intrinsic to all surveys, including this one. Furthermore, we were unable to conclude what specific ergonomic practices surveyed led to the development/incidence of MSK injuries due to a lack of matched control group. A control group outside of plastic surgery (office workers, laborers, etc.) could have also allowed for comparison to the general population. We were also not able to conduct a non-responder analysis. Therefore, this research opens the door to future investigation as to the direct causality of MSK injuries and how this compares to that of the general population.

CONCLUSION

MSK injuries are prevalent in craniofacial plastic surgeons and may impact both physical and emotional wellness. This study found that a high percentage of craniofacial surgeons have developed MSK injuries whereas some have reported a negative impact on their sleep and emotional well-being. Further research will help to define practices that both prevent and cause MSK injuries and may be applicable to surgeons of all disciplines, promoting a happy and healthy career.

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