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Spinal pain in undergraduate dental students at the University of Otago Faculty of Dentistry

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Abstract

Background and objectives: Musculoskeletal spinal pain is commonly reported by dentists and dental students. This study aimed to investigate the point prevalence of spinal pain and disability resulting from spinal pain in undergraduate dental students at the University of Otago Faculty of Dentistry in 2019 and compare the results to those from 2017.

Methods: 262 Bachelor of Dental Surgery (BDS) students in four-year groups completed an online questionnaire on spinal pain and their ability to manage everyday life. The survey investigated three regions of the spine (lumbar, thoracic and cervical). Respondents scored average disability from their pain based on location using the relevant Oswestry Disability Score. Scores were calculated for each spinal region and results were compared to an identical survey carried out in 2017.

Results: BDS3 and BDS4 students in each year studied had the highest lumbar spine Oswestry scores. There was no significant difference between BDS2 and BDS5 Oswestry disability scores in any region and there was no difference between 2017 and 2019 cohorts. Compared to the 2017 survey, trends for pain prevalence and related disability in 2019 appeared similar for disability, pain severity and spinal regions involved.

Conclusions: Non-specific spinal pain exists in dental students at a level that is likely not clinically relevant. Based on the results of this study, it doesn't appear that spinal pain and disability increases as student's progress through the BDS programme.

Introduction

Musculoskeletal pain in the neck, back and shoulder region is commonly experienced by dentists, and has been well documented in the literature (Rundcrantz et al., 1990; Lehto et al., 1991; Rundcrantz et al., 1991;Leggat & Smith 2005; Rising et al., 2005; Leggat & Smith, 2006; Morse et al., 2010; Chaiklieing & Suggaravetsiri 2015; Ng et al., 2016; Vijay & Ide 2016; Radanović et al., 2017; Kapitán et al., 2018). A systematic review of musculoskeletal symptoms of dentists found that the prevalence of musculoskeletal pain ranges between 64 – 93 %, with the highest prevalence for pain being the back (36.6 – 60.1 %) and neck (19.8–85 %) (Hayes, Cockrell, & Smith, 2009). Prolonged static posture and repeated upper limb movements during clinical work along with a small working field, intensive lighting, noise, and psychosocial stress are thought to be contributory factors (Kapitán et al., 2018). Musculoskeletal disorders represent a major occupational health hazard for dentists, contributing to increased sick leave, reduced economics, decreased productivity, and early retirement (Marshall et al., 1997; Leggat & Smith 2006; Rising et al., 2005; Kanteshwari et al., 2011; Vijay & Ide 2016). Furthermore, it has been reported that younger and less experienced dentists are more likely to report musculoskeletal pain of the neck, back and shoulders, compared to their more experienced colleagues (Chowanadisai et al., 2000; Leggat & Smith, 2006). Research suggests that neck, shoulder and back pain begins for some, early in their dental training and increases throughout the duration of study (Kapitán et al., 2018). Undergraduate training may therefore be an important time to correct issues that contribute to musculoskeletal pain before they develop.

There is currently no published literature reporting musculoskeletal pain in New Zealand dentists or dental students. However, three surveys have been conducted to determine the point prevalence of spinal pain in BDS students at the University of Otago. A pilot survey was undertaken in 2013, but this data is unpublished and inaccessible. A second data set collected in 2017 was available for analysis. This study aimed to investigate the point prevalence of spinal pain and disability from lumbar, thoracic, and cervical pain reported by students in the BDS programme in 2019, as well as to assess whether there was difference in spinal pain and disability between the 2017 and 2019 BDS cohorts.

Methods

Ethics approval was obtained from the university of Otago Human Ethics Committee (D13/135) for this research. Participants were asked to complete an electronic survey with questions related to lumbar, thoracic, and cervical spine pain. The Oswestry Disability questionnaires, that have been widely used for the assessment of lumbar and cervical spinal pain were used (Fairbank et al., 1980; Fairbank & Pynsent 2000; Davidson & Keating, 2002). For the thoracic spine the lumbar spine Oswestry Low Back Disability questionnaire was reworded, in the absence of a tool that was similar to the lumbar and cervical Oswestry Disability questionnaires. These tools were chosen to help understand the spinal pain as they assess disability from pain across a range of functions. The survey was distributed among BDS students at the University of Otago, and an information sheet outlining the aim of the study and a consent form were attached at the beginning of the survey. Participants were contacted to complete this survey in

March and April 2019 via an online link. BDS3 and BDS4 classes were approached during simulation sessions and BDS2 and BDS5 before lectures. In addition, the survey link was posted to respective class Facebook pages and emailed out to students with regular reminders.

Responses to the survey were anonymous but questions regarding basic demographics were asked including age, gender, weight, height, ethnicity and current BDS class.

An identical survey had been sent to BDS students at the University of Otago in 2017, and the results from each survey were anonymous.

Those who recorded no pain and no significant disability from pain were deemed to have no spinal pain in that region (Fairbank et al., 1980). For the rest, disability scores were calculated for each region of the spine and the results were derived for each BDS class to allow comparison across the cohorts.

Multiple comparisons were made between the BDS classes in each year group using Kruskal Wallis tests for each spinal region. Some of the 2019 BDS4 and BDS5 students may have completed the survey as 2017 BDS2 and BDS3 students but as the results were anonymous, there was no way of determining this. As a result, only individual classes from each year cohort were compared to the later year using t tests to determine whether there was any change over time in the class cohorts (i.e. BDS2 2017 cohort lumbar results were compared to BDS2 2019 cohort lumbar results etc). Statistics were performed using GraphPad Prism (version 9.2.0 (283), GraphPad Software, San Diego, California USA, www.graphpad.com).

Results

The 2017 survey (S17) and 2019 survey (S19) had a total response rate of 46.7 % (n=158) and 72.9 % (n=262), respectively. Respondents to Survey S19 ranged between 18 and 45 years, with the majority of respondents being female (64.5 %). The average height of participants was 168 cm, and the average weight was 65 kg. Specific response rates for each BDS class in the S19 survey are shown on Table 1.

In 2017 there were no reports of cervical disability across the years of dental school (BDS2- BDS5) (Table 2). In 2019 the proportion of students with clinically relevant cervical disability across the years of dental school were not different (chi squared exact statistic = 0.062).

Comparing the two years there were no differences between BDS2 cohorts. The proportion of clinically relevant cervical disability for BDS4 was higher in 2019 than 2017 (chi squared exact statistic = 0.025). There were no differences in the proportion of clinically relevant cervical disability when comparing data from 2017 to 2019 for both BDS3 and BDS5 (both chi squared exact statistic ≥ 0.187). The percentage of participants with clinically significant disability from their spinal pain is shown in Table 2.

In 2017 the proportion of those with clinically relevant thoracic disability was different across the years of dental school (BDS2 – BDS5; chi squared exact statistic > 0.004). Specifically, the proportion of those reporting clinically relevant thoracic disability was higher in BDS3 and BDS4 compared to BDS5 (both chi squared exact statistic ≤ 0.037); there were no other differences (all chi squared exact statistic ≥ 0.166). In 2019 the proportion of those with clinically relevant thoracic disability was not different across the years of dental school (BDS2 – BDS5) for 2019 (chi squared exact statistic = 0.829). The 2017 BDS4 cohort reported a higher proportion of clinically relevant thoracic disability than in 2019 (chi squared exact statistic = 0.025). There were no other differences between the proportions reporting clinically relevant thoracic disability between 2017 and 2019 (all chi squared exact statistic ≥ 0.346). In 2017 there were no reports of clinically relevant lumbar disability across the years of dental school (BDS2- BDS5). In 2019 the proportion of those reporting clinically relevant lumbar disability across the years of dental school was also not different (BDS2 – BDS5; chi squared exact statistic ≥ 0.272).

Table 1. Demographic data of survey S19 (2019) responders

BDS year group	Average respondent age (years)	Average respondent weight (kg)	Average respondent height (cm)	No male respondents	No female respondents	Response rate (%)
BDS 2	20	65	168	10	35	58.4
BDS 3	21	65	168	32	48	87.9
BDS 4	22	66	168	28	47	79.2
BDS 5	24	65	167	23	39	66.0

Table 2. Percentage of participants with clinically significant disability from their spinal pain

	Cervical				Thoracic				Lumbar			
	2017		2019		2017		2019		2017		2019	
	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N
BDS2	0	0/21	0	0/45	0	0/21	4.4	2/45	0	0/21	2.2	1/45
BDS3	0	0/31	8.7	7/80	9.7	3/31	5.0	4/80	0	0/31	6.3	5/80
BDS4	0	0/45	10.7	8/75	14.0	6/43	2.7	2/75	0	0/46	6.4	5/75
BDS5	0	0/60	3.2	2/62	0	0/60	3.2	2/62	0	0/60	1.6	1/62

Table 3. Oswestry Scores for those with clinically relevant disability from their spinal pain.

	Cervical				Thoracic				Lumbar			
	2017		2019		2017		2019		2017		2019	
	Mean/SD	n/N	Mean/SD	n	Mean/SD	n/N	Mean/SD	n/N	Mean/SD	n/N	Mean/SD	n/N
BDS2	NA	0/21	NA	0/45	NA	0/21	23/(0.02)	2/45	NA	0/21	24/(NA)	1/45
BDS3	NA	0/31	27/(0.08)	7/80	22/(0)	3/31	26/(0.03)	4/80	NA	0/31	24/(NA)	5/80
BDS4	NA	0/45	32/(0.08)	8/75	24/(0.02)	6/43	22/(0)	2/75	NA	0/46	26/(0.03)	5/75
BDS5	NA	0/60	27/(0.07)	2/62	NA	0/60	22/(0)	2/62	NA	0/60	24/(NA)	1/62

Table 4. Reported rates of spinal pain/disability

	N	Neck/Shoulder	Neck	Mid spine	Lower	Any Spinal Pain
Rising	256	42%		29%	25%	
Samoladas	55					49%
Hodacova	73	53%		76%	57%	
BDS 2017	158		0%	6%	0%	
BDS 2019	262		6%	4%	5%	

There were no differences between the proportions reporting clinically relevant lumbar disability between 2017 and 2019 for BDS2, BDS3, BDS4, and BDS5 (all chi squared exact statistic ≥ 0.156).

The Oswestry Scores for those with clinically relevant disability from their spinal pain is shown in Table 3.

Discussion

Results from Survey S17 and Survey S19 indicate that very few BDS students of any year level had pain or clinically relevant disability from pain in the lumbar, thoracic, and cervical regions (Schwind et al., 2013). This is significantly lower that other cohorts (Rising et al., 2005; Samoladas et al., 2018; Hodačová et al., 2022). This is likely for several reasons. Some groups asked if participants had any pain as well as worst pain and duration of pain so when any pain is considered the reported rates will be much higher than those who have no pain or no pain that gives clinically relevant disability (Rising et al., 2005; Samoladas et al., 2018). Other studies used a rating of mild, moderate, severe (Hodačová et al., 2022). This type of questioning will result in much higher rates of reported spinal pain (Table 4).

Only small numbers of BDS students reported significant disability from cervical spinal pain. More BDS4 students from 2019 reported significant disability (8/75) compared to the 2017 cohort (0/45). Given that this was the only cohort of the 4 years that showed a difference and the numbers are small we do not think this is necessarily an important consideration. In the three 2019 BDS class cohorts who reported significant disability from cervical pain there was no difference between the class groups.

A similar effect was seen in thoracic spine related disability. The BDS3 and BDS4 2017 classes reported higher incidences of disability than the other classes of that year and the 2019 year, but again the total numbers were small and the reported disability scores are not different between classes and years except 2017 BDS2 and BDS5 where no students reported disability.

In the lumbar spine, no 2017 students reported disability and only very small numbers in the 2019 cohort with those who did have disability having low Oswestry scores.

No trend to worsening rates of spinal pain/disability or degree of severity as students move through dental school training has been reported by others (Rising et al., 2005). In contrast other studies have shown worsening rates of spinal pain/disability as students' progress through dental school (Samoladas et al., 2018; Hodačová et al., 2022).

Both these cohorts that had increasing rates of pain through the dental school years suggested that the increase may have been due to the introduction to clinics for the first time. While not investigated in this study, BDS3 students are placed under a unique stress where they are providing clinical treatment for patients for the first time, and the transition from second to third year involves a transition to clinical hours in addition to ongoing hours in simulation clinics. A small number of BDS3 students may struggle to cope initially with the positional load that comes with increased clinical practice, that may lead to greater pain experienced. Students may, for example, not undergo correct patient positioning or use indirect vision to gain an optimal view of the patient's teeth and mouth. In turn, this can lead to awkward and unnatural posturing, placing more stress on their spinal discs (Gupta et al., 2014). Rundcrantz and colleagues concluded that dentists who carefully positioned their patients in the chair and used a mirror to facilitate a direct view suffered less discomfort and had a significantly lower frequency of headaches (Rundcrantz et al., 1990). Having a more comfortable patient and being more comfortable as a dentist should normally make it easier to cope with the mechanical loads of positioning while working.

Students in BDS4 have clinical hours and provide treatment of complexity that is significantly greater than BDS3, in addition to an increase in the dentistry-related theoretical workload. Psychosocial stress as a risk factor for musculoskeletal pain has been well documented in the literature (Rising et al., 2005; Aghahi et al., 2018;

Kapitán et al., 2018) and may contribute to the slightly higher rates of pain and disability in BDS4 students.

It has been documented that an upward trend of work-related musculoskeletal pain exists from second to fourth year of dental school, and this finding has been attributed to the difference between nature of clinical work and working hours (Rising et al., 2005; Khan & Chew, 2013).

In contrast, BDS5 students did not report more spinal pain/disability compared to BDS3 and BDS4 students, despite having the greatest number of weekly clinical sessions. By BDS5, dental students may have developed improved coping strategies, utilisation of correct postural techniques and mirror vision skills along with improved clinical skills compared to those in BDS3 and BDS4 students. This may explain why there was no progression of lumbar spine pain or disability as students' progress through the course so that they exit with no more pain than when they started. It may also be that the loads involved in clinic were long enough for students to become stronger and better able to cope with positional loads on the spine. The 2005 report by Rising et al investigating body pain in dental students showed similar findings, with final year dental students experiencing less spinal pain compared to more junior students (Rising et al., 2005). These findings suggest that spinal pain is multifactorial and not solely influenced by the cumulation of clinical hours, but also technique. BDS5 students are also more likely to utilise clinical aids such as lights and loupes (Barazanchi et al., 2020), which has been suggested as contributing to preventing or managing musculoskeletal issues by facilitating a more upright posture (Vijay & Ide, 2016). The reported benefits of loupes in the literature are however, still limited and uncertain (Ng et al., 2016).

Whilst it is not possible to compare Oswestry Lumbar spine scores with Oswestry Cervical spine scores, qualitatively there is a suggestion in the 2019 cohort of more students with slightly more pain/disability in cervical region than the lumbar region. Leggat & Smith reported that the most common musculoskeletal symptom in dentists was neck (57.5 %), followed by the lower back (55.3 %) and shoulder (53.3 %) pain (Leggat & Smith, 2006). Melis et al. reported an investigation of musculoskeletal symptoms in dental students using a comparison group of psychology students that was matched for age and gender (Melis et al., 2004). Results showed that dental students more commonly report neck pain compared to psychology students. In our surveys, headaches were the most frequently reported symptom of cervical pain. Similarly, Marshall et al reported a 58 % prevalence of headaches among Australian dentists (Marshall et al., 1997) and Melis et al. determined that headaches were the most reported symptoms among Sardinian dental students (Melis et al., 2004).

This research is subject to several limitations. Due to a low participation rate in Survey S17, we cannot be confident that the data is generalisable for the class population. Survey S19 results can be deemed more reliable as its greater participation rate minimises the risk of selection and response bias. The nature of self-reporting could lead to overestimation of pain, as students who experience pain are more likely to take an interest in undertaking the survey. This may have led to a greater reported average respondent score, particularly in the earlier survey where fewer respondents took part in the study. Furthermore, the cross-sectional nature of the study does not allow us to establish causal relationships. As a result, it cannot be inferred that spinal pain reported was caused by dental-related activities, or by other means such as physical activity or a previous injury. This study does not compare results to a baseline population of similarly aged university students undertaking disciplines dissimilar to dentistry. We are therefore unable to conclude whether BDS students have a higher reported pain prevalence compared to a baseline population.

Respondents were asked to report pain experienced that day, which is not representative of spinal pain experienced across the entire year. Surveys S17 and S19 were conducted at different points in the year, with Survey S19 across March and April, and Survey S17 in July. This meant data was compared from students responding for different stages of the year, and there may be a periodic or cumulative variation not accounted for. However, information bias was minimised due to self-reporting only occurring that day, therefore students are very likely to recall their pain experience. Furthermore, the questionnaires were sent out to students electronically which enabled students to have taken the survey more than once, and not all students answered every question in the survey. Three students in Survey S19 did not state their BDS year and were excluded from the analysis.

Some students who responded to Survey S19 as BDS4 and 5 students may have participated in the S17 survey as BDS2 and 3 students respectively. However, the anonymous nature of the survey means that comparisons cannot be made between these groups. There were fewer students who participated in S17 than S19, but had the S17 numbers been greater and participants able to be identified across the two years of the study, further conclusions about the nature of spinal pain and related disability in relation to the BDS course loads may have been possible.

The BDS curriculum should aim to implement strategies to improve students' clinical working positions. While spinal pain is not present for most students, there are a small number with significant pain. A greater focus on technique will serve to reduce physical stress, prevent occupational diseases, improve productivity and ultimately provide more comfort to both the operator and patient (Gupta et al., 2014). From an early stage, tutors could provide feedback on student posture as part of clinical grading, and four handed dentistry should be advocated.

Further investigations are required to clarify the impact of back, neck and shoulder pain in dental students, and to identify specific risk factors that contribute to spinal pain. The timing of this study is unique as Survey S17 was carried out in a 1960s building (Walsh Building) that was refurbished in 1980 and Survey S19 was

undertaken prior to moving to the new Clinical Services Building (CSB) in July 2019. The CSB provides a modern dental environment, with significantly improved lighting, temperature, operator chairs with back support and dental chairs with pre-set positioning of patients. Future studies will be of interest to note whether a change occurs in the prevalence of lumbar, thoracic and cervical pain and related disability with the facilities in the CSB supporting improved ergonomics.

Conclusions

This research provides an insight on spinal pain and related disability experienced by dental students in New Zealand. It found that cervical, lumbar and thoracic pain and related disability exists in BDS students but at rates much lower than has been reported in the literature. Due to limitations in this study, causation of spinal pain in a dental setting cannot be proved, and a population for comparative data is required before conclusions can be drawn. This study did show, however, that non-specific spinal pain does exists in dental students but that spinal pain has not worsened by the time students reach final year. Despite this, spinal pain in dentists and dental students has been reported in the literature and therefore early implementation of strategies to improve students' clinical technique and working positions are important to help reduce the symptoms of spinal pain during the four years of training, and potentially to reduce risks related to spinal pain in future practice.

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Conflicting interests

The authors declare that there is no conflict of interest.

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