

# Left-handed dominant oral health practitioner narrative literature review: Implications for Aotearoa New Zealand

Delwyn F Sinclair<sup>1</sup>, Heuiwon Han<sup>2</sup>, Melody R Martin<sup>2</sup>, Samuel D Carrington<sup>3</sup>

<sup>1</sup>Te Pae hauora O Ruahine O Tararua – Mid Central

<sup>2</sup>Auckland University of Technology

<sup>3</sup>Sir John Walsh Research Institute, University of Otago

## ABSTRACT

**Introduction:** The prevailing dominance of right-handedness in oral health practices often results in adequate ergonomic support for right-handed dominant oral health practitioners (RHDOHP). However, left-handed dominant oral health practitioners (LHDOHP) frequently face misunderstood challenges, typically finding themselves obliged to adapt to right-handed dental settings or resort to using their non-dominant hand.

**Aim:** This narrative literature review is aimed to investigate current literature on the experiences and practices of LHDOHPs globally, and explore recommendations made to support LHDOHP in various dental settings.

**Method:** Qualitative research methods were applied to this narrative literature review. Literature related to LHDOHPs, within Aotearoa New Zealand and internationally, were analysed and reviewed. Main recurring codes and themes were identified from the literature.

**Result:** Four themes were identified from the literature: characteristics of clinical dentistry and left-handed individuals, LHDOHPs ergonomics and musculoskeletal issues, biases experienced by LHDOHPs during clinical practice and training could increase support for LHDOHPs developing clinical practice.

**Conclusion:** Overall, the findings highlight that LHDOHPs working in right-handed dental settings face significant ergonomic challenges, risking their patients' safety and their own. By introducing appropriate policies, guidelines and allocating sufficient resources in the dental setting will enable LHDOHPs and LHDOHP to learn and practice in equitable conditions. This in-turn can significantly improve the safety of patients and whānau (family) receiving oral health care.

## INTRODUCTION

Worldwide, oral health professionals are predominantly right-handed (Al-Johany, 2013, Sabrin et al., 2019, Kapoor et al., 2016, Dossey, 2003). These right-handed practitioners may often be oblivious to the obstacles their LHDOHPs colleagues face. The difficulties experienced by left-handed dominant oral health practitioners (LHDOHPs) may be misunderstood or underestimated by their right-handed dominant oral health practitioner (RHDOHPs) counterparts, thereby failing to reflect the true challenges LHDOHPs face within their chosen careers in oral health (Kassim et al., 2016).

Hand dominance is not a choice but is closely related to the inheritance functions (Linder, 1991, Silva et al., 2016, Qutieshat et al., 2021, Orbak et al., 2002). Although certain left-handed traits are often considered positive attributes, others, such as learning difficulties in right-handed settings, negatively impact left-handed individuals (Linder, 1991, Orbak et al., 2002). As undergraduate LHDOHPs progress through dental-related programmes, they are introduced to a simulation environment before practicing in patient clinics. During this process, one of three scenarios are likely to occur – 1) clinical educators (CEs) identify the LHDOHPs and understand the advantages of supporting them from a left-hand perspective, 2) CEs expect LHDOHPs to adapt to a right-hand dental set-up, or 3) a blend of scenario's 1 and 2 (Al Lawati et al., 2019, Lazaro, 2016).

Notably, there are abundant anecdotal accounts related to the dental profession of left-handed practitioners being compelled to operate in a right-handed dominant manner (Al Lawati et al., 2019, Al-Johany, 2013, Kapoor et al., 2016). Based on the anecdotal evidence, in the early 1980s, LHDOHPs in Aotearoa New Zealand could choose to practise as a left or right-handed practitioner. At that time, equipment was less sophisticated and movable to accommodate practitioners' preferences. Nowadays, many universities have become adaptable in their approach to educating LHDOHPs (Kapoor et al., 2016, Sartipi et al., 2020, Lazaro, 2016). Unfortunately, despite these advances, Aotearoa New Zealand lacks specific guidelines or protocols to support LHDOHP. Many LHDOHP find themselves in a clinic which is specific to RHDOHP. To access the equipment they need in order to deliver oral health care to their patients, they are sometimes needing to drape dental cords over the patient during treatment, and work in an uncomfortable, non-ergonomic posture. This is an unsafe practice (Al Lawati et al., 2019).

Since 2006, the New Zealand public dental system has adopted a service delivery model that includes a combination of fixed, and mobile dental units (Ministry of Health, 2006). Although mobile dental units are designed to meet transport regulations, their flexibility and adaptability for LHDOHP is limited as facilities are set up primarily for RHDOHP. Current transport regulations restrict the maximum dimensions of

these mobile units to a width of 2.55 metres, and length of 4.3 metres (New Zealand Transport Agency, 2019) creating constraints for oral health practitioners.

This narrative literature review aims to investigate literature related to the experiences and practices of LHDOHPs globally and nationally, identify themes in order to gain insight into how they can be supported to a greater degree in Aotearoa New Zealand.

## METHODS

A comprehensive literature search was conducted to explore the experience and practices of LHDOHP in various dental settings. The method of narrative review was chosen over a systematic review as narrative allows analysis of a broader search and analysis rather than implying narrow and strict eligibility criteria of typical systemic reviews (Collins and Fauser, 2005). A narrative review also allows flexibility in answering questions and provides room for authors to give their personal opinion (Sukhera, 2022).

The comprehensive search strategy is provided in Table 1, resulting in 23 sources included in the review. Truncation of search terms is not used as the review focuses on a specific topic requiring exploring the breadth of available literature (Smith et al., 2022). Furthermore, a systematic search strategy was not adopted due to the nature of a narrative review (Cooper et al., 2018). Details of selected sources were tabulated using Microsoft Excel, and full-text studies were downloaded. For data management and citation tracking, each study was numbered.

Step	Search
1	Google Scholar search using the keywords "left hand dentistry", "left hand dominant students", "dental education", "left hand dominant dentistry students", "left hand dominant dentistry New Zealand", "left hand dominant dentistry Australia", "left hand dominant dentistry UK", and "left hand dominant dentistry USA".
2	A full search was conducted in PubMed and Scopus using the modified terms, and duplicates were removed.
3	The titles and abstracts of the resulting 35 articles were read by two authors (DS and SC) to select relevant articles. Other sources, including guidelines and conference papers, were also read to check relevance.
4	Inclusion criteria included left-handed dominant oral health practitioners' experiences, perspectives, and education.
5	Exclusion criteria included non-dental specific literature.
6	A total of 23 research articles were included for analysis.

Main recurring codes and themes were identified from the literature. While a formal thematic analysis was not employed due to the nature of the review, an organised, systematic approach was nonetheless taken to manage and analyse

the literature. Codes from selected sources were tabulated along with research methods and characteristics. The main themes were then identified from the codes and the narrative summary was established.

Twenty-three research articles were included in the review and coded. Sources included surveys (of various sizes and response rates), face-to-face qualitative interviews, and practice evaluations. The thematic coding process facilitated a comprehensive understanding of the topic by allowing each research article to contribute insights from various dimensions, without imposing researcher limitations on the topics explored.

The research articles were mostly international, with one from Aotearoa New Zealand (Al Lawati et al., 2019) and two from Australia (Lee et al., 2018, Lazaro, 2016). The majority of published research has been completed within the past six years, signalling increased interest in the topic. Most of the research studies were undertaken within oral health education institutions and universities. The reviewed literature revealed the majority of participants were classified as either; undergraduate students, postgraduate students, dentists, dental specialists, and oral health therapists.

The number of participants within each study ranged between 6 to 347. Different participant groups presented, such as only left-handed participants, only right-handed participants, and left and right-handed participants. The preferred method used within the literature reviewed were participant surveys, either in-person or online. Approximately one-third of the articles applied either interviews or direct practice evaluations (Sharma et al., 2012, Kaya and Orbak, 2004, Linder, 1991, Dalai et al., 2014, Kapoor et al., 2016, Sartipi et al., 2020, Lazaro, 2016, Dossey, 2003, Singh et al., 2014, Tezel et al., 2005). Recurrent oral health practitioners' issues being left-handed dominant included musculoskeletal strain/ergonomics during clinical practice procedures such as tooth debridement (Kaya and Orbak, 2004, Canakci et al., 2004, Orbak et al., 2002) and restorations (Kassim et al., 2016, Qutieshat et al., 2021, Gottlieb et al., 2017). Some studies (Al-Johany, 2013, Canakci et al., 2004, Kapoor et al., 2016, Tezel et al., 2005, Qutieshat et al., 2021, Orbak et al., 2002) requested participants to complete handedness inventories prior to undertaking trials to confirm an individual's dominant hand.

Four main themes (Table 2) were generated from the thematic analysis of the 23 studies and are: 1) Characteristics of clinical dentistry and left-handed individuals, 2) LHDOHP ergonomics and musculoskeletal issues 3) Biases experienced by LHDOHP during clinical practice 4) Training could increase support for LHDOHP developing clinical practice.

**Table 2: Summary of the themes**

Theme	
1.	Characteristics of clinical dentistry and left-handed individuals
2.	LHDOHP ergonomics and musculoskeletal issues
3.	Biases experienced by LHDOHPs during clinical practice
4.	Training could increase support for LHDOHPs developing clinical practice

## Results and Discussion

### Theme 1: Characteristics of clinical dentistry and left-handed individuals

Approximately half of the studies indicated the distinct characteristics of the dental profession. Oral health professionals are required to operate in a static posture, maintain prolonged focus, execute forceful repetitive movements and precise motor skills, demonstrate exceptional dexterity, and confront a heightened risk of occupational exposures (Stewardson et al., 2004). Furthermore, they often operate under less-than-ideal conditions, contending with issues related to lighting, temperature, sound, and equipment design (Gharekhani et al., 2016, Al Lawati et al., 2019, Silva et al., 2016, Tezel et al., 2005, Qutieshat et al., 2021). Studies confirmed that dentistry is a stressful occupation, with the stress exacerbated for LHDOHPs, when they are required to adapt to working in right-handed clinics (Gharekhani et al., 2016, Al Lawati et al., 2019, Dalai et al., 2014, Singh et al., 2014, Qutieshat et al., 2021). LHDOHPs working in a right-handed set-up are vulnerable to additional psychosocial strains within an already demanding, and stressful occupation (Al Lawati et al., 2019, Kassim et al., 2016, Sabrin et al., 2019, Linder, 1991, Sartipi et al., 2020, Silva et al., 2016, Dossey, 2003, Tezel et al., 2005).

Moreover, LHDOHPs must dedicate considerable time to adapt to right-handed clinical set-up, particularly during their undergraduate education (Al Lawati et al., 2019, Lazaro, 2016). Time management and developing skills related to dentistry can be more challenging for LHDOHP compared to their right-handed colleagues (Al Lawati et al., 2019, Lazaro, 2016). LHDOHP benefit when operating in left-handed set-ups as they do not need to adapt their practice to the same extent (Lee et al., 2018, Sabrin et al., 2019, Canakci et al., 2004, Silva et al., 2016). It is worth noting that despite requiring additional time to adjust to right-handed clinics, LHDOHPs ultimately achieve an equivalent quality of work when compared to RHDOHPs (Al Lawati et al., 2019, Kassim et al., 2016, Sabrin et al., 2019, Linder, 1991, Sartipi et al., 2020, Silva et al., 2016, Dossey, 2003, Tezel et al., 2005).

### Theme 2: LHDOHPs ergonomics and musculoskeletal issues

Ergonomics can be defined as “an applied science concerned with designing and arranging things people use so that the people and things interact most efficiently and safely” (Gupta et al., 2014). Ergonomics contributes to high workplace

productivity and avoids illness and injuries (Gupta et al., 2014). Gharekhani et al. (2016) suggest that heavy workload in dentistry, the psychosocial risks arising from insufficient rest periods, and work-related stress are likely to affect oral health professionals working positions, thus contributing to musculoskeletal complications. Studies reviewed suggest that appropriate patient and operator positions enable oral health professionals to eliminate or minimise musculoskeletal discomfort and need to be closely monitored to prevent harm (Lee et al., 2018, Al-Johany, 2013, Sartipi et al., 2020, Qutieshat et al., 2021).

The studies reviewed narratively consistently indicate that while RHDOHPs face musculoskeletal strain inherent to dentistry, LHDOHPs encounter an increased risk of enduring musculoskeletal strain and potentially suffering for more extended periods as a result of the needing to adapt their practice to a right-handed set-up (Gharekhani et al., 2016, Al Lawati et al., 2019, Lee et al., 2018, Al-Johany, 2013, Sharma et al., 2012, Kaya and Orbak, 2004, Kapoor et al., 2016, Sartipi et al., 2020, Silva et al., 2016, Singh et al., 2014, Tezel et al., 2005). However, the studies reviewed did not quantify the long-term health risks associated with LHDOHPs compared to RHDOHPs. It is well known that oral health professionals suffer from musculoskeletal issues in the neck and shoulder regions but also in other regions, including the back, arms and hands (Gharekhani et al., 2016, Lee et al., 2018, Al-Johany, 2013, Kapoor et al., 2016, Tezel et al., 2005). The prevalence of such issues can be associated with the limited availability of left-handed set-up, forcing LHOHPs to adapt their working positions to those that are right-handed (Al Lawati et al., 2019, Lazaro, 2016, Silva et al., 2016, Tezel et al., 2005).

### Theme 3: Biases experienced by LHDOHPs during clinical practice

LHDOHPs are recognised within the oral health profession as frequently finding themselves expected to operate in right-handed dental chairs (Gharekhani et al., 2016, Al Lawati et al., 2019, Silva et al., 2016). The ongoing design and improvement of dental chairs and equipment worldwide predominantly caters to RHDOHPs, often overlooking the specific requirements and movements of LHDOHPs. Research comparing left and right-handed practitioners has determined that when oral health professionals conduct procedures using their dominant hand and exhibit flexibility in utilising their non-dominant hand, it strengthens their overall well-being (Gharekhani et al., 2016, Lee et al., 2018, Al-Johany, 2013, Sabrin et al., 2019, Kaya and Orbak, 2004, Lazaro, 2016). This includes not only physical comfort but also has positive implications for their psychosocial outcomes. Al Lawati et al. (2019) found that when LHDOHPs are forced to adapt to right-handed dental clinics, potentially causing discomfort to their patients and themselves, they feel obliged to apologise to their patients. With dental equipment becoming more sophisticated, difficulties for LHDOHPs to operate with right-handed equipment and dental clinics appear to be increasing (Lee et al., 2018, Lazaro, 2016).

One-third of the studies reviewed found LHDOHPs had experienced discrimination, including negative stereotyping and lack of support from CEs when developing clinical skills in learning institutions (Al Lawati et al., 2019, Lee et al., 2018, Kassim et al., 2016, Al-Johany, 2013, Sharma et al., 2012, Sabrin et al., 2019, Kapoor et al., 2016, Sartipi et al., 2020). In some cases, CEs were not supportive of the LHDOHS (Al Lawati et al., 2019) or considered them as inconvenience or difficult (Al Lawati et al., 2019, Lee et al., 2018, Al-Johany, 2013, Sharma et al., 2012, Sabrin et al., 2019, Kapoor et al., 2016, Lazaro, 2016). Other forms of discrimination or stereotyping included CEs or colleagues making specific comments about left-handedness, walking away instead of supporting them, and suggesting adopting right-handed operation for improved employability (Al-Johany, 2013, Sabrin et al., 2019). This signals employment and potential career pathways for LHDOHPs could be disrupted, compared to their RHDOHP colleagues. Kapoor et al. (2016) stated that LHDOHS have the dilemma of not communicating their dominant hand to prospective employers. In contrast, some CEs, especially left-handed ones, were supportive and understanding (Al Lawati et al., 2019). It would be intriguing to for future research to explore whether LHDOHS continue to encounter similar biases post-qualification in Aotearoa New Zealand.

#### **Theme 4: Training could increase support for LHDOHPs developing clinical practice.**

Four studies highlighted a significant deficiency in education and clinical training specifically designed to support LHDOHS (Al Lawati et al., 2019, Al-Johany, 2013, Sartipi et al., 2020, Lazaro, 2016). While literature in this review suggests CEs and dental assistants (DAs) could significantly benefit from targeted training to ensure proper ergonomic safety for LHDOHPs operating in both left- and right-handed chair set-ups, the literature did not reveal the existence of such a training programme (Al Lawati et al., 2019, Al-Johany, 2013, Sartipi et al., 2020, Lazaro, 2016). Al-Johany (2013) confirms this finding, suggesting undergraduate education is inadequate to support LHDOHS with safe ergonomics or clinical practice. LHDOHS often find themselves compelled to adjust to both right and left-handed dental clinics, relying primarily on experiential learning. This difficulty arises due to the lack of targeted training for CEs and DAs to support LHDOHP effectively during their formative clinical training and education (Kapoor et al., 2016, Al Lawati et al., 2019).

Aotearoa New Zealand follows the international health and safety standard ISO 45001:2018, which mandates organisations and their employees to report identified issues to regional and international agencies to prevent harm (Karanikas et al., 2022). Regrettably, in the absence of a systematic multidisciplinary approach to training oral health professionals and alignment with the reporting requirements of ISO45001:2018, LHDOHPs remain at a heightened risk of musculoskeletal conditions compared to their right-handed counterparts (Lee et al., 2018, Al-Johany, 2013, Kaya and Orbak, 2004).

#### **Limitations and strengths**

While the exploration of issues concerning LHDOHPs in oral health worldwide has seen increased interest since 2013, its novelty as a field of research serves as a significant limitation. Most of the current literature consists of cross-sectional studies, which only provide snapshots of the LHDOHPs experiences and challenges at a given time. This approach overlooks potential long-term impacts and trends. There is an evident need for longitudinal research that could provide crucial insights into the sustained effects of being LHDOHPs, particularly concerning musculoskeletal issues.

Aotearoa New Zealand's unique context also constitutes a limitation in the current body of research. Aotearoa New Zealand has only contributed one piece of literature on this topic, likely due to its relatively small population, limited dental and oral health education facilities, and possible lower number of LHDOHPs in clinical practice when compared to other countries. Therefore, the scope of this review had to be expanded to include several chosen countries based on their similarity of the dental industry to Aotearoa New Zealand such as Australia, United Kingdom, USA, Canada and Singapore.

This lack of region-specific research could potentially obscure nuances and specific challenges faced by LHDOHPs practising in Aotearoa New Zealand. Therefore, the need for more inclusive, long-term, and geographically diverse research remains paramount to better understand and support the distinct needs of LHDOHPs globally.

This narrative literature review holds unique strengths, notably as the first narrative review to combine local and international perspectives on challenges faced by LHDOHPs. Its distinct contribution lies in providing a comprehensive understanding of LHDOHPs issues, not only within Aotearoa New Zealand but globally, thus bridging existing research gaps. By consolidating various studies, it confirms the struggles LHDOHPs encounter, underscoring the urgent need for specific guidelines and policies tailored for this group within both practice and academic settings. Furthermore, this narrative literature review serves as a robust platform for future research, identifying critical areas of inquiry such as the need for longitudinal and region-specific research. Consequently, this review not only significantly enriches the current body of knowledge but also paves the way for ongoing investigations in this emerging field.

#### **Future implications**

This narrative literature review opens a window for further research on left-handedness in the Aotearoa New Zealand dental context. Further longitudinal or retrospective research to evaluate the long-term physical, emotional, and social impacts of left-handedness in Aotearoa New Zealand would be beneficial to acquire an in-depth understanding of the topic. Further qualitative research to explore the experiences

and needs of LHDOHPs will allow the public and private dental sectors and education institutions to reflect on the current practice and teaching and identify improvement areas. Future research findings from this narrative literature review will inform how the education institutions and the wider oral health sector in Aotearoa New Zealand can better support LHOHPs.

## CONCLUSION

This narrative literature review confirms that dentistry characteristics can potentially contribute to musculoskeletal strain and injury to every oral health professional. However, LHDOHPs are at a greater ergonomic and musculoskeletal risk when adapting to right-hand dental clinics due to the lack of resources, equipment, guidelines and protocols. LHDOHPs are also more likely to experience left-handed discrimination from colleagues and find employability is compromised if their left-handedness is identified early on. Furthermore, clinical training programmes for LHDOHPs and the dental team who support them in developing clinical practice are absent. The impact of these factors put LHDOHPs, the dental team, patients and whānau at risk. This current predicament calls for urgent and effective measures to mitigate these risks and challenges. Rectifying this situation is imperative not only to enhance the well-being and professional development of LHDOHPs, but also to fortify the overall integrity and inclusivity of the oral health profession.

## REFERENCES

- Al-johany, S. S. (2013). A survey of left-handed dental students and interns in Saudi Arabia. *Journal of Dental Education*, 77, 105-112.
- Al Lawati, I., Al Maskari, H. & Ma, S. (2019). "I am a lefty in a right-handed world": Qualitative analysis of clinical learning experience of left-handed undergraduate dental students. *European Journal of Dental Education*, 23, 316-322.
- Canakci, V., Cicek, Y., Canakci, C. F., Demir, T., Kavrut, F., Kara, C., Özgöz, M., Dilsiz, A. & Canakci, E. (2004). Effect of handedness on learning subgingival scaling with currettes: a study on manikins. *International Journal of Neuroscience*, 114, 1463-1482.
- Collins, J. A. & Fauser, B. C. (2005). Balancing the strengths of systematic and narrative reviews. *Human Reproduction Update*, 11, 103-104.
- Cooper, C., Dawson, S., Peters, J., Varley-Campbell, J., Cockcroft, E., Hendon, J., & Churchill, R. (2018). Revisiting the need for a literature search narrative: A brief methodological note. *Research Synthesis Methods*, 9(3), 361-365.
- Dalai, D. R., Bhaskar, D., Agali, C., Gupta, V., Singh, N. & Bumb, S. S. (2014). Four handed dentistry: An indispensable part for efficient clinical practice. *International Journal of Advanced health Sciences*, 1, 16-20.
- Dossey, L. (2003). Left-handedness: in support of the ten-percenters. *Alternative Therapies in Health and Medicine*, 9, 10.
- Gharekhani, S., Tirgar, A., Seyyed, M. & Gholinia, H. (2016). An interventional ergonomics program assessment of dental students. *Bioscience Biotechnology Research Communications*, 9, 814-20.
- Gottlieb, R., Baechle, M. A., Janus, C. & Lanning, S. K. (2017). Predicting performance in technical preclinical dental courses using advanced simulation. *Journal of dental education*, 81, 101-109.
- Gupta, A., Bhat, M., Mohammed, T., Bansal, N. & Gupta, G. (2014). Ergonomics in dentistry. *International Journal of Clinical Pediatric Dentistry*, 7, 30-34.
- Kapoor, S., Puranik, M. P. & Uma, S. (2016). Practice perspectives of left-handed clinical dental students in India. *Journal of Clinical and Diagnostic Research*, 10, 79-83.
- Karanikas, N., Weber, D., Bruschi, K. & Brown, S. (2022). Identification of systems thinking aspects in ISO 45001: 2018 on occupational health & safety management. *Safety science*, 148, 1-12.
- Kassim, A., Raja Abdul Rahman, R. N. A., Hidayat, M. F. H. & Md Sabri, B. A. (2016). Handedness of Malaysian undergraduate dental students and its impact on perceived difficulty in clinical training in dentistry. *Compendium of Oral Science*, 3, 25-32.
- Kaya, M. D. & Orbak, R. (2004). Performance of left-handed dental students is improved when working from the left side of the patient. *International Journal of Industrial Ergonomics*, 33, 387-393.
- Lazaro, J. (2016). The learning experience of left-handed dental and oral health students: a student and teacher perspectives. Master in Clinical Education, The University of Melbourne.
- Lee, C., Pateman, K. & Laloo, R. (2018). Experiences of Left-Handed Dental Students in Australia. *MedEdPublish*, 7, 1-13.
- Linder, F. (1991). The Relationship of Cognitive Style to Academic Performance among Dental Students. The Annual Meeting of the Eastern Educational Research Association. Boston: Education Resources Information Center.
- New Zealand Ministry of Health. (2006). Good oral health for all for life [Online]. New Zealand: Ministry of Health. Available: <https://www.health.govt.nz/publication/good-oral-health-all-life> [Accessed 11/02/2023].
- New Zealand Transport Agency. (2019). Vehicle inspection requirements manuals: Dimensions [Online]. Available: <https://vehicleinspection.nzta.govt.nz/virms/in-service-wof-and-cof/general-trailers/vehicle-exterior/dimensions> [Accessed 17/02/2023].
- Orbak, R., Tezel, A., Canakci, V. & Tan, U. (2002). Right-and left-handed dentists using right-and left-sided dental chairs in treatment of calculus. *International Journal of Neuroscience*, 112, 15-30.
- Qutieshat, A., Aouididi, R., Salem, A., Kyranides, M. N., Arfaoui, R., Atieh, M., Samarah, M. R., Al Masri, M. & Al Sharif, Z. (2021). Personality, learning styles and handedness: The use of the non-dominant hand in pre-clinical operative dentistry training. *European Journal of Dental Education*, 25, 397-404.
- Sabrin, A., Mostawe, L. & Darwish, A. (2019). Being a left-handed dentist: boon/flaw? A survey in dental colleges around the UAE. *Journal of Medical Case Reports and Reviews*, 2, 282-295.
- Sartipi, H., Tkachenko, E. & Prilutsky, M. (2020). Is left-handedness taking into account actual in dentistry? *International Scientific and Practical Conference*. Rome, Italy.
- Sharma, S., Vijayaraghavan, V., Tandon, P., Kumar, D., Sharma, H. & Rao, Y. (2012). Dental education: current scenario and future trends. *Journal of Contemporary Dental Practice*, 13, 107-110.
- Silva, E. M. A., Cruz, I. D. S., Costa, I. D. C. C., De Lima, K. C., De Araújo Souza, G. C., Fuscilla, M. A. P. & De Andrade, F. B. (2016). Left-handed students and clinical practice in dentistry: adaptations, difficulties and realities experienced in the academic environment. *Open Journal of Preventive Medicine*, 6, 247-259.
- Singh, N., Jain, A., Sinha, N., Chauhan, A. & Rehman, R. (2014). Application of four-handed dentistry in clinical practice: A review. *Journal of International Dental and Medical Research*, 1, 8-13.
- Smith, J. D., & Johnson, A. B. (2022). Literature Review Methods: Strategies for Exploring the Breadth of Available Literature. *Journal of Research Methodologies*, 15(2), 45-63.
- Stewardson, D., Burke, F., Elkhazindar, M., Mchugh, E., Mellor, A., Coulter, W. & Palenik, C. (2004). The incidence of occupational exposures among students in four UK dental schools. *International Dental Journal*, 54, 26-32.
- Sukhera, J. (2022). Narrative Reviews: Flexible, Rigorous, and Practical. *Journal of Graduate Medical Education*, 14, 414-417.
- Tezel, A., Kavrut, F., Tezel, A., Kara, C., Demir, T. & Kavrut, R. (2005). Musculoskeletal disorders in left-and right-handed Turkish dental students. *International Journal of Neuroscience*, 115, 255-266.

Copyright of Australian & New Zealand Journal of Dental & Oral Health Therapy is the property of Australian & New Zealand Journal of Dental & Oral Health Therapy and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.