READ ME FOR CPD

The ergonomic benefits of Guided Biofilm Therapy

By Jennine Bywaters

During the career of a dental health professional, the risk of a work-related musculoskeletal disorder is considerable. Musculoskeletal disorders, or MSDs, are injuries that affect the musculoskeletal system such as muscles, tendons, ligaments and nerves and therefore the ability to perform the normal range of movements.[1]

The majority of injuries are the cumulative result of overuse of the muscles, joints and tendons over time. Overuse induces inflammation in the muscles, creating pressure on the surrounding nerve fibres and blood vessels. Studies from Australia and the rest of the world indicate rates of MSDs in dental professionals to be between 63% and 93%.[2] Symptoms of MSDs have been reported by dental and oral health therapy students during their time at university, prompting the need for increased undergraduate ergonomic training for the dental health professions.[3]

The symptoms of an MSD include tingling or numbness, pain, inflammation, loss of strength or loss of function.[4] Musculoskeletal disorders impact on productivity and job satisfaction and may require time off for treatment or a reduction in working hours. The resultant pain or loss of function can impact on activities in daily life, creating stress and pressure on family relationships. Indeed, the associated pain and loss of function has been recognised as the leading cause of early retirement.[5]

Figure 1. Most work-related musculoskeletal disorders affect the wrists, hands, elbows, neck and shoulders.

The causes of musculoskeletal disorders are well documented and multifactorial. Our awkward and static working positions and the repetitive nature of the tasks we perform overwork the muscles in the back, neck, shoulders, arms and hands. Muscles require adequate rest periods to allow the vascular system to restore nutrients to the muscles and remove waste lactic acid. The failure to provide rest periods results in fatigue and muscle inflammation, increasing the risk of injury or nerve impingement. Although fatigue can be reversed by short periods of rest, many clinicians work to tight schedules and long clinical days. It is therefore imperative to work in a manner that reduces fatigue and the risk of injury.

Hand scaling and root debridement requires periods of repetitive movements, often with significant force and features in many studies as causative in the injury process.[6] The small muscles in the fingers and hands are designed for fine motor skills and the repetitive actions, time and force required for hand debridement can quickly fatigue these muscles. Whilst MSDs can affect all dental professionals, those performing predominantly hygiene tasks may be at a higher risk of developing hand, arm and shoulder injuries.[7]

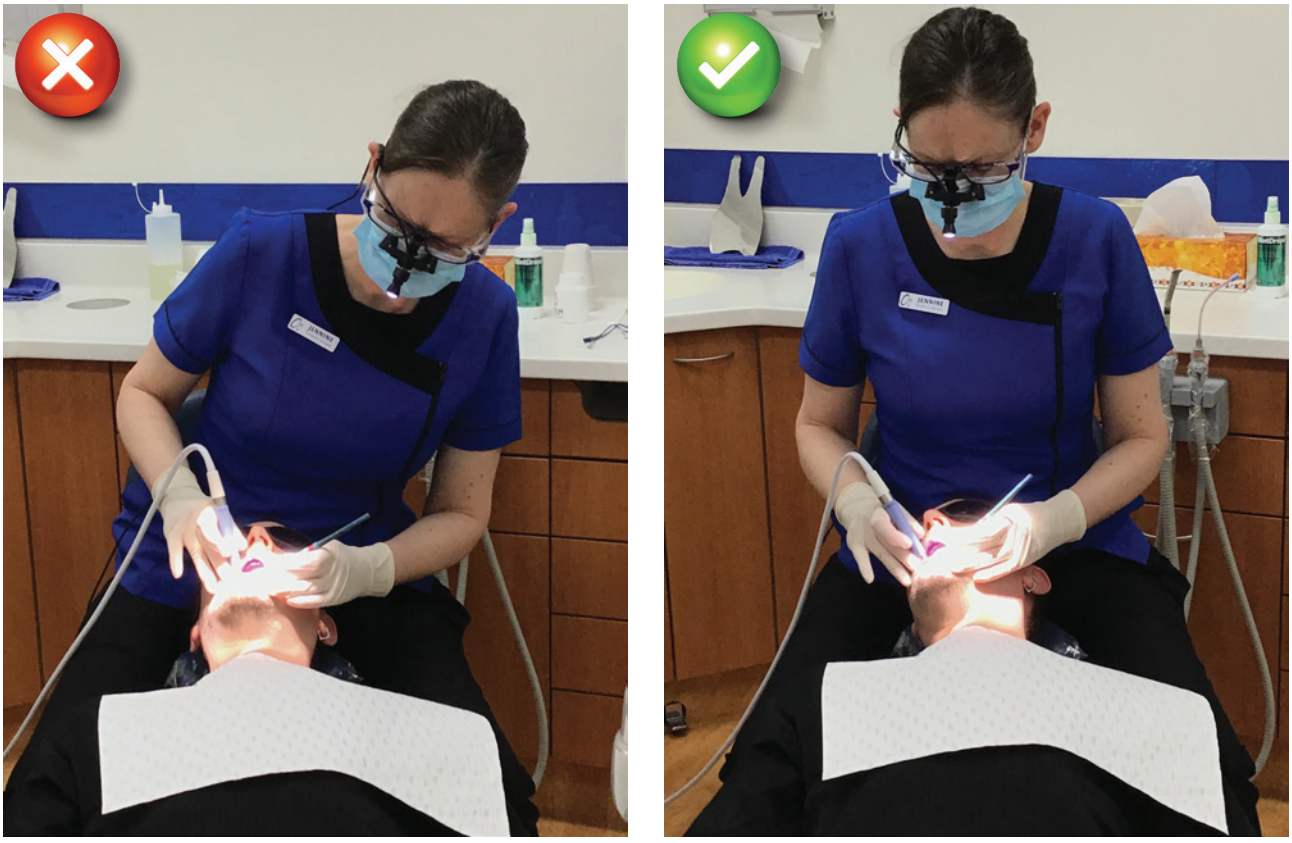

Figure 2. Incorrect posture (left) versus correct posture (right).

Figure 3. The original AIRFLOW, PERIOFLOW and PIEZON technologies (Image courtesy of Prof. Magda Mensi).

Preventive strategies have typically focused on improved posture and patient positioning, minimising muscle activity with lighter weight and thicker handled instruments and scheduling adequate rest breaks and stretching to reduce fatigue.[8] Clinicians are encouraged to adjust both the patient and operator chairs to minimise the risk of poor posture. A healthy posture will limit the amount of forward tilt of the head and spine and allow the elbows to remain by the clinician's side.

Despite these strategies, the repetitive hand movements prominent in a dental hygiene appointment have remained largely unchanged.

Up until the relatively recent introduction of Guided Biofilm Therapy, it has been difficult to imagine an effective means of maintaining the periodontal health of a patient without extensive hand instrumentation and the use of a contra-angled handpiece with a rubber cup and prophy paste.

Guided Biofilm Therapy (GBT), incorporating subgingival air polishing using erythritol, has been recognised as a game changer for providing periodontal maintenance for our patients. The technologies of EMS AIRFLOW® and PIEZON® are demonstrated to deliver comparable clinical outcomes to conventional methods of debridement but with the advantage of being minimally invasive on both hard and soft tissues and with significantly improved patient comfort scores.[9]

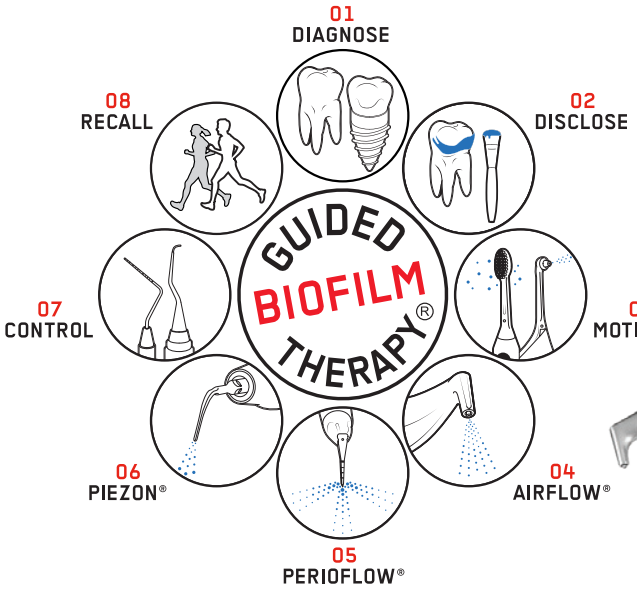

Figure 4. The 8 steps of Guided Biofilm Therapy.

Figure 5. The AIRFLOW Handpiece is held 3-5mm from the tooth or implant surface. No direct contact means no pressure on the tooth.

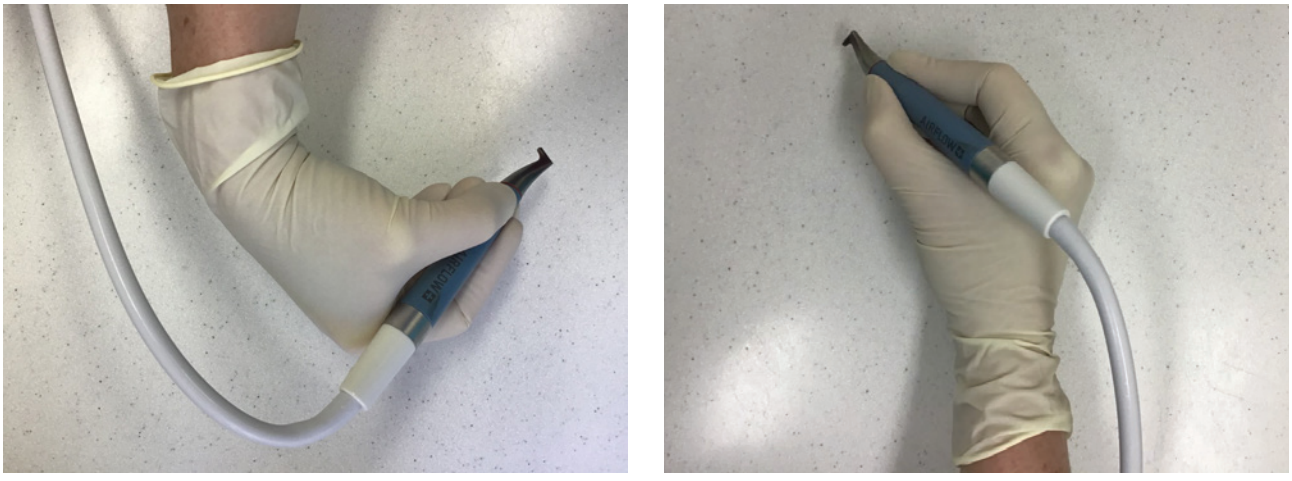

Figure 6. Wrist in flexion position increases the risk of MSDs (left) whereas having the wrist in the neutral position reduces the risk of fatigue and injury (right).

The GBT protocol encompasses 8 steps that provide a thorough clinical assessment of the periodontal and peri-implant tissues; disclosing and plaque control motivation; biofilm removal from supra and subgingival sites; calculus removal; caries detection and the allocation of a suitable recall period. Each of the 8 steps of the GBT protocol offer opportunities for the clinician to address posture, patient positioning, lighting and magnification, all of which can reduce the risk of injury. The GBT protocol provides the clinician with a framework for the efficient use of time, reducing the stress that can negatively impact on posture and the ability to make decisions.

The steps utilising EMS AIRFLOW, PERIOFLOW® and PIEZON provide the greatest ergonomic benefits to the clinician by providing an efficient and effective means of supra and subgingival biofilm removal without the risks inherent in the "old recipe" of hand instrumentation and the use of a handpiece and rubber cup. To maximise the ergonomic benefits of GBT, clinicians benefit from a thorough understanding of the protocol, the properties of erythritol powder and the appropriate clinical applications. Employing subgingival air polishing to perform for optimal results will reduce the expenditure of energy on unnecessary tasks.

The key ergonomic differences of the EMS technologies, compared with the conventional instruments, are the weight of the handpieces, the force required during use and the vibration produced.

The weight of our instruments determines the amount of muscle activity required to perform the task.[10] The less muscle activity required, the longer it takes for the fine muscles in the fingers and hands to fatigue and the lower the risk of injury.

A weight comparison between the EMS AIRFLOW and cord and the contra-angled handpiece and cord used in the practice revealed that the AIRFLOW equipment was 26% lighter than the

Figure 7. The correct use of AIRFLOW results in minimal hand movements.

Figure 8. The PIEZON PS Instrument in action.

contra-angled equipment. This weight difference is the equivalent of holding two curettes as well as the AIRFLOW handpiece. The reduction in overall weight is significant when the cumulative risk is considered.

Muscle activity is required to both hold the contra-angled handpiece and maintain pressure of the prophy cup on the tooth surface. The vibration emitted by the handpiece further increases the muscle activity to control the handpiece. Vibration can result in overstimulation of the fine muscles in the fingers and hands. The combination of vibration and the need to control the contra-angled handpiece creates fatigue for these muscles, especially when the polishing stage is preceded by heavy hand debridement.

In contrast, the AIRFLOW handpiece is held 3-5 mm from the tooth or implant surface. The absence of direct contact demands no exertion to maintain pressure on the tooth. The air, water and erythritol spray is directed at the gingival sulcus to remove biofilm from the supragingival surfaces and up to 4 mm subgingivally. The absence of vibration necessitates no additional muscle activity to control the handpiece. Using AIRFLOW, clinicians can provide a minimally invasive procedure to remove biofilm in a manner that is ergonomically advantageous.

The weight of our instruments, the vibration emitted and the amount of control required all impact on the amount of pinch force necessary to hold the instrument. Pinch force describes the amount of pressure exerted by the thumb and forefinger during the modified pen grasp. Heavier instruments demand a greater pinch force and more reliance on adequate finger rests to control the instrument. Thinner instruments require a greater pinch force, especially to safely perform the precise movements of hand scaling. Adequate finger rests can decrease the pinch force required, reducing hand muscle load and the risk of injury.[11] The finger rests required to support the AIRFLOW handpiece are light and often soft tissue rests are sufficient.

The ergonomic benefits of the AIRFLOW handpiece are not limited to the reduced weight and pinch force. The ability to adjust the angle of the spray by rolling the handpiece in the fingers minimises wrist movements. Repeated flexion and extension of the wrist are the greatest risk factors for carpal tunnel syndrome, a common injury for clinicians. These movements can create inflammation in the soft tissues surrounding the carpal tunnel, placing pressure on the median nerve housed within the sheath. In females, the carpal tunnel is finer and less inflammation is required to create pressure on the nerve and the resulting pain.[12] Maintaining the wrist in a neutral position maximises the power of the hand muscles and minimises the risk of inflammation due to overuse.

A neutral wrist position can be maintained by adjusting the patient's head position during treatment to access certain areas of the mouth. The effectiveness of AIRFLOW is determined by the angle of the spray and distance from the tooth. The lingual of the lower molars often requires the clinician to flex the wrist to obtain the correct angle for biofilm removal. The clinician is more likely to lean to one side to obtain better vision, further compromising posture. Turning the patient's head will provide direct vision of the lingual aspect and allows the clinician to maintain a neutral wrist position and correct posture.

Wrist and hand movements can be further limited by using AIRFLOW firstly on the same aspect of each tooth or implant in a quadrant (e.g. mesial) and then returning on the distal aspects. The correct use of AIRFLOW results in minimal hand movements.

The removal of biofilm from the deeper subgingival sites, up to 9 mm, is performed with the PERIOFLOW handpiece. The flexible nozzle on the PERIOFLOW enables the clinician to access awkward furcations and pockets without the need to overly extend or flex the wrist, removing biofilm that would normally require considerable hand debridement. The PERIOFLOW handpiece requires a low pinch force and emits no vibration.

The GBT protocol for the removal of calculus focuses on PIEZON with a PS tip. The long, fine PS tip can access up to 10 mm subgingivally without distending the tissues in the pocket.

The PIEZON PS Instrument utilises a linear movement and efficient calculus removal is dependent on the placement of the lateral surface of the tip against the tooth or root surface. Mastering the correct technique of using the PS Instrument will remove calculus with minimal pressure and the PIEZON handpiece can be

controlled using a light pinch force. The low force required during the use of an ultrasonic scaler significantly reduces the load on the forearm muscles.[13]

The AIRFLOW Prophylaxis Master incorporates PIEZON with a unique feedback system to automatically adjust the power output dependent on the resistance encountered on the tooth surface. On a smooth surface, the clinician should hear minimal noise from the PIEZON and the sound increases only slightly on encountering resistance. The resultant reduction in vibration is noticeable to the clinician. The high-pitched sound commonly associated with ultrasonic use indicates an incorrect angle of the tip and excessive pressure. The combination of AIRFLOW, PERIOFLOW and PIEZON to remove biofilm reduces the need for hand instrumentation.

The use of GBT is likely to shorten the clinical appointment by 5-7 mins. This allows time for the fine muscles to rest and for the clinician to adopt a different posture whilst completing clinical notes or walking the patient to the reception area.

Dental clinicians have long reported musculoskeletal disorders and associated pain as a result of providing good quality care to their patients. To significantly reduce the risk of injury, clinicians have needed a game changer to more comfortably perform their tasks. The EMS technologies of AIRFLOW, PERIOFLOW and PIEZON have considerable ergonomic advantages to the conventional methods of debridement.

About the author

Jennine Bywaters graduated in 1987 from Curtin University with an Associate Diploma in Dental Therapy. She has attained the Cert. Health Education, a BSc in Health Promotion and a Grad Dip in Occupational Health and Safety. She has been a clinical demonstrator for student dental hygienists at Curtin University and participates in the clinical placement programme. Jennine joined Alliance Periodontics & Implant Dentistry in West Perth in 2016. She is passionate about periodontal health and works closely with the Periodontist, Dr Wendy Gill to achieve the best outcomes for their patients.

Like EMS Dental - Australia & New Zealand on Facebook for the latest product updates, promotions and exclusive events - visit facebook.com/emsAusNZ

Figure 9. The EMS AIRFLOW Prophylaxis Master.

References

1. Van Eerd D, Munhall C, Irvin E, et al (2016). Effectiveness of workplace interventions in the prevention of upper extremity musculoskeletal disorders and symptoms: an update of the evidence. Occupational and Environmental Medicine. 73:62
2. Gopinadh, A., Devi, K.N.N., Chiramana, S., Manne, P., Sampath, A., Babu, M.S. (2013). Ergonomics and musculoskeletal disorder: as an occupational hazard in dentistry. J Contemp Dent Pract. 14(2):299-303
3. Ng, A., Hayes, M.J., Polster, A. (2016). Musculoskeletal disorders and working posture among dental and oral health students. Healthcare. 4: 13.
4. Gupta A, Bhat M, Mohammed T, Bansal N, Gupta G. (2014). Ergonomics in Dentistry. Int J Clin Pediatr Dent. 7(1):30-34.
5. Das, H., Motghare, V., Singh, M. (2018). Ergonomics in dentistry: narrative review. International Journal of Applied Dental Sciences. 4(4): 104-110
6. Lietz, J., Kozak, A., Nienhaus, A. (2018). Prevalence and occupational risk factors of musculoskeletal diseases and pain among dental professionals in Western countries: A systematic literature review and meta-analysis. PLoS One. 13(12): e0208628
7. Johnson, C., Kanji, Z. (2016) The impact of occupation-related musculoskeletal disorders on dental hygienists. Can J Dent. 50(2):72-79
8. Mulimani, P., Hoe, V.C.W., Hayes, M.J., Idiculla, J.J., Abas, A.B.L., Karanth, L. (2014). Ergonomic interventions for preventing musculoskeletal disorders in dental care practitioners. Cochrane Database of Systematic Reviews. Issue 8. Art. No.: CD011261. DOI:10.1002/14651858.CD011261.
9. Müller, N., Moëne, R., Cancela, J.A., Mombelli, A. (2014). Subgingival air-polishing with erythritol during periodontal maintenance. J Clin Periodontol. 41:883-889
10. Suedbeck, J.R., Tolle, S.L., McComs, G., Walker, M.L., Russell, D.M. (2017). Effects of handle design on dental hygienists' forearm muscle activity during scaling. J Dent Hyg Jun;91(3):47-54.
11. Dong, H., Barr, A., Loomer, P., Rempel, D. (2005). The effects of finger rest positions on hand muscle load and pinch force in simulated dental hygiene work. Journal of Dental Education. Apr, 69(4) 453-460
12. Bhandari, S.B., Bhandari, R., Uppal, R.S., Grover, D. (2013). Musculoskeletal disorders in clinical dentistry and their prevention. J Orofac Res. 3(2): 106-114
13. Åkesson, I., Balogh, I., Hansson, G.Å. (2012). Physical workload in neck, shoulder and wrists/hands in dental hygienists during a work-day. Applied Ergonomics. 43(4): 803-811.