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InTouch
Clinical update for healthcare workers with an interest in safety and infection prevention

ISSUE 11



HAND ERGONOMICS IN DENTISTRY

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Patty is a Clinical Consultant in the medical device industry. She received her bachelor's degree from the University of Western Ontario, Canada with major emphasis in nursing and psychology. With international experience as a Registered Nurse in Canada, England and the United States, she focused on perioperative nursing, infection control, business development, marketing and education. Being an active member of professional associations and networking groups for more than 30 years is a key factor in her professional growth and success. Patty utilizes her years of experience in healthcare, knowledge of perioperative practice, and concern for infection prevention to support product development and clinical research, create accredited continuing education courses, lecture, and author articles.

LEARNING OBJECTIVES

1. Increase awareness of hand fatigue and the impact among dental practitioners through review of clinical data.
2. Describe the role of medical glove use in dental practices and the part they play with hand fatigue.
3. Review practice modification and minimizing hand fatigue with ergonomically designed dental gloves.

INTRODUCTION

Musculoskeletal disorders (MSDs) among dental practitioners is cited as the main reason for early retirement.[1] MSDs are the result of static posture, precise and repetitive motions, long work hours, and substandard ergonomics during dental practice.[2] These disorders fall into 3 categories: neck and shoulder disorders, hand and wrist disorders, and back disorders.[3] The prevalence of these MSDs among dentist and dental hygienists and can range from 64-93%, with chronic hand and wrist pain prevalence at 40-75 %.[4,5,6]

Since fewer dental professionals fully recover from hand pain than they do from neck, shoulder or elbow pain, it is imperative that hand injury be prevented.[7] This Clinical Update examines musculoskeletal disorders of the hand, the impact of glove use, and best practice for medical glove selection that reduces the risk of ergonomic injury, thereby improving clinical practice through increased wearer performance, dexterity, comfort and safety.

ERGONOMICS & WORK-RELATED INJURIES

Ergonomics is defined as 'an applied science concerned with designing and arranging things people use so that people and things interact most efficiently and safely'; also called biotechnology, human engineering, or human factors. Simply said, ergonomics is the practice of preventing work-related musculoskeletal disorders (WRMSDs). Successful implementation of ergonomic practices increases productivity, reduces illnesses and injuries, and boosts satisfaction among dental professionals.[8] In contrast unsuccessful implementation of ergonomic practices, can lead to WRMSDs.

An injury is considered to be work-related if a workplace risk factor either caused or contributed to the resulting condition. WRMSDs generally affect the muscles, nerves, blood vessels, ligaments, joints, and tendons. Most WRMSDs develop over time and they can progress from mild to severe disorders. These disorders are seldom life threatening but they impair the quality of life of a large proportion of the adult population. In fact, work related MSDs account for 33% of all worker injury and illness cases in the USA (2013);[9] 36% of all serious worker injury and illness claims in Australia (2017-18);[10] 37% of all worker injury and illness cases in the UK (October 2019);[11] and 33-39% of worker injury and illness cases in the European Union (2010).[12]

HAND & WRIST WORK-RELATED RISK FACTORS

Work-related hand/wrist disorders develop from the physical clinical activities performed by dental professionals. Risk factors that may contribute to muscle fatigue and the development of MSDs of the hand include: exerting excessive force; excessive repetition of movements; awkward postures or unsupported positions; static postures or positions that a worker must hold for long periods of time; compression which can concentrate force on small areas of the body; inadequate recovery time due to overtime, lack of breaks, and failure to vary tasks; and excessive vibration, usually from vibrating dental tools/drills, which can decrease blood flow, damage nerves, and contribute to muscle fatigue.[13]

These risk factors, either alone or in combination, can subject dental practitioners' hands and wrists to thousands of repetitive twisting, forceful, or flexing motions during a typical workday. Additionally, when a glove is worn that restricts hand movement the dental clinician must exert more muscle effort to perform procedures, thereby increasing the risk of strain which can lead to hand fatigue or injury.[14]

IMPACT OF HAND & WRIST MSDS

Hand/wrist complaints among dentists and especially dental hygienists are highly prevalent. Hand/wrist complaints follow low back disorders and result in a significant higher chronicity than any other complaint.[15] An early American Dental Association (ADA) study found that 9.2% of dentists had been diagnosed with a repetitive motion disorder, causing 19% to require surgery and 40% to work reduced hours.[16] Another study found that 71% of dentists experienced Carpel Tunnel Syndrome (CTS) symptoms, although only 7% where diagnosed with CTS.[17]

As for dental hygienists', studies report the prevalence of hand pain in hygienists compared to dentists to be 75% vs 38% respectively; while the prevalence rates of CTS in dental hygienists were significantly higher than dentists with varying reports of 6.4% to 11%, 23%, and 50%.[18] Additionally, hygienists who had practiced more than 10 years were almost twice as likely to manifest symptoms associated with CTS than those with fewer years in the profession.[19] Studies further demonstrate both the dominant and non-dominant hands to be at risk for developing an MSD.[20] Haghighi cites the pressure imposed on the non-dominate hand (wrist/palm) during retraction of the cheek and tongue as the potential cause.

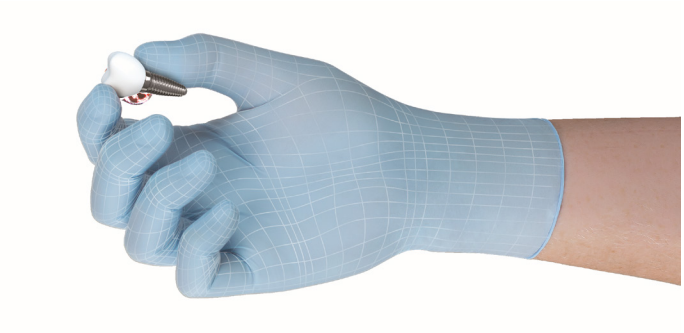
Although there are numerous pain syndromes of the hand and wrist (i.e., De Quervain's Syndrome, Guyon's Canal Stenosis, and Trigger Finger) to which dental professionals are predisposed; Carpal Tunnel Syndrome is the most prevalent. According to the Mayo Clinic, CTS is caused by pressure on the median nerve. The median nerve runs from your forearm through a passageway in your wrist (carpal tunnel) to your hand. It provides sensation to the palm side of your thumb and fingers, except the little finger. It also provides nerve signals to move the muscles around the base of your thumb (motor function). Anything that squeezes or irritates the median nerve in the carpal tunnel space may lead to carpal tunnel syndrome. When the median nerve is compressed, numbness, tingling and weakness in the hand and arm may be experienced. Workplace factors that require working with vibrating tools or performing prolonged and repetitive hand motions and flexing of the wrist can contribute to carpal tunnel syndrome.[21]



PHYSICAL IMPACT OF WEARING GLOVES

Medical gloves provide a bidirectional barrier protecting both the dental professional and the patients they care for from the transmission of pathogens during use. Glove selection is important, as this glove should also support dental staffs' comfort, performance and productivity by providing dexterity, grip, tactility and muscle control vital to successfully performing dental procedures. With concerns related to latex allergy, dental clinicians are selecting nitrile as a suitable alternative. While nitrile gloves have been found to be comparable to latex gloves in barrier protection, puncture resistance, and durability, they are often thicker with reduced elasticity, which could result in reduced dexterity for fine motor skills as compared to latex gloves.[22,23,24] This increased thickness, reduced elasticity and subsequent rigidity may cause hand fatigue and potential MSDs in dental providers' when these gloves are worn for long periods of time.

The results of a 2012 ergonomic study demonstrated that, wearing gloves in general significantly increased the muscle activity, wrist deviation, and discomfort whilst reducing hand grip strength, forearm torque strength and touch sensitivity.[25] Ergonomists have further noted that the thickness of a glove can significantly impact the user's performance while carrying out manual clinical activities. A study (Willms, Wells, & Carnahan 2009) showed that thicker gloves decreased grip strength/force while increasing muscle effort/activity, caused interference with hand movement; increased performance time/duration, and reduced dexterity and tactility.[26] Additionally, poorly fitting gloves, whether too small or too large, affect all aspects of glove use and are a detriment to performance.



EVOLUTION OF ERGONOMICS & MEDICAL GLOVES

We can no longer simply rely on medical glove regulatory standards as a guideline for the development of medical gloves. Current regulatory standards only address barrier properties of a glove – the specifications for protecting the wearer and patient from the spread of infection. We must also meet the ergonomic requirements of the dental professionals who will be wearing gloves. The integration of ergonomic principles into medical glove design is based on satisfying a need for comfort, worker productivity, and worker health and well-being. The key to uniting the opposing principles of ergonomics and protection lies in altering the development process to include the dental worker's experience at the onset of glove design ideation and leveraging the insight gained to develop new glove technologies.[27,28]

In the last few years, there has been an increase in the range of ergonomic products available, including medical gloves. According to United States (U.S.) Ergonomics "A product that has received certification provides measurable ergonomic benefits to the anticipated users by improving comfort and fit and by minimizing the risk factors that may contribute to the development of ergonomic injuries." A comprehensive study conducted by U.S. Ergonomics found that particular brands of ergonomic certified gloves markedly reduced muscle effort compared to other leading competitors' brands. In side-by-side testing, the ergonomic gloves even outperformed bare-hand manipulations in some cases, showing a reduction in muscle effort compared to not wearing gloves.[29] This lessened muscle effort, reduces the chances of developing injuries, pain and MSDs of the hand and wrist.

Ultimately, innovations in formulation, material type, and texture all contribute to a softer, more comfortable, better fitting and better gripping nitrile glove. Ergonomic design technology/science then advances glove architecture to the next level taking into account exertion, flexibility, pinch grasp, precision tasks, tactility, and sensitivity to improve and support muscle movements, protecting dental practitioners and reducing the likelihood of developing MSDs. Those responsible for glove purchasing decisions need to think beyond the required regulatory standards and consider the crucial benefits offered by gloves with ergonomic certification.



CONCLUSION

This review clearly demonstrates that dental professionals rely heavily on their hands to perform clinical activities, and that long-term strain and muscle exertion are recognized risk factors which lead to various MSDs and injuries. These MSDs & injuries subsequently result in a financial toll through loss of productivity, medical costs, loss of wages and even early retirement. New innovative ergonomically designed and certified glove solutions have proven to help reduce muscle strain and improve muscle performance in the hand, wrist and arm. They can minimize the risk of injury, meet regulatory compliance, improve practice performance and increase safety. An easy hand injury prevention strategy to implement!

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ISSUE11.INTOUCH.29.04

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