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OCCUPATIONAL HAND DISORDERS IN DENTISTRY

Dr. Mikael Zimmerman
DDS, PhD, Associate Professor

Dr. Malin Zimmerman
MD, PhD, Associate Professor

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WRITERS BIOGRAPHY



Dr. Mikael Zimmerman

DDS, PhD, Associate Professor

Dr. Mikael Zimmerman has been working in private enterprise since 2000 with a focus on hygiene and infection control, quality assurance, and development in dentistry. He is an Associate Professor in Clinical Oral Diagnosis at Karolinska Institute, Stockholm, Sweden. Previously, he served on the Dental Faculty, responsible for a special clinic for patients with immunodeficiencies (mainly HIV/AIDS), and the need for special attention when receiving dental care. He also serves as an International Advisor in infection control issues in both the dental and medical field in public, private, health institutions, and regulatory affairs groups.

Dr. Malin Zimmerman

MD, PhD, Associate Professor

Dr. Malin Zimmerman is an Orthopedic Surgeon at Helsingborg Hospital in Sweden. Her clinical practice is focused on orthopedic trauma and hand surgery. She serves as an Associate Professor in orthopedic research at Lund University in Sweden, mainly focused on peripheral nerves, diabetes complications in the upper limb and the effect of socioeconomic factors on upper extremity conditions.





Work-related musculoskeletal disorders (WMSDs) and discomfort are common among dental healthcare providers. Among 70% of all dental healthcare providers report musculoskeletal disorders, most commonly from the neck and the upper extremity.¹ Dental hygienists and therapists seem to have higher prevalence rates for WMSDs in wrists and hands as compared to dentists. Hand problems are an important area to address, and to adopt preventative strategies to maintain a sustainable work life. In this ebook, we will provide an overview of WMSDs and discomfort in the hand relevant to the dental healthcare provider, treatment options for these, and effective prevention strategies.

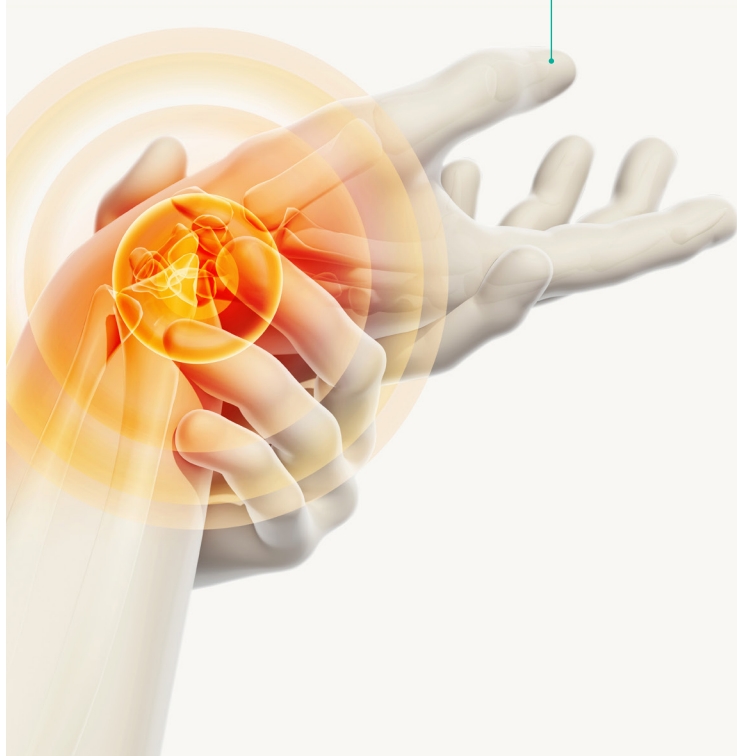
HAND FATIGUE

Hand fatigue is defined as the hand muscles failing to produce the force required, and multiple biological mechanisms contribute to the symptoms. Hand fatigue leads to more performed errors, impaired steadiness and dexterity, and overall impaired function of the hand when trying to perform a specific task.² Hand fatigue is a symptom often caused by repetitive tasks at low loads. Both hand fatigue and carpal tunnel syndrome may hence be caused by the same occupational risk factors, both conditions affecting hand performance, and symptoms may be similar.



CARPAL TUNNEL SYNDROME

Carpal Tunnel Syndrome causes numbness, tingling, impaired dexterity, and pain in all fingers except the little finger.



Carpal Tunnel Syndrome (CTS) is the most common peripheral nerve entrapment syndrome in the upper extremity, with a prevalence of 3-4% in the general population.³ CTS occurs when the median nerve is compressed when passing through the tight carpal tunnel in the wrist. It is more common among women, and risk factors include advancing age, diabetes, rheumatoid arthritis, obesity, hypothyroidism, and occupational factors. In many countries, CTS is recognized as an occupational health disorder. Work-related risk factors for developing CTS include vibrating hand-held tools, repetitive movement, static postures, and use of excessive force.⁴ CTS causes numbness, tingling, impaired dexterity, and pain in all fingers except the little finger. In advanced cases, there might be a wasting of the muscles innervated by the affected nerve. Among dental practitioners, symptoms of CTS are reported among 30%.^{5,6} CTS treatment options include night splints, to keep the wrist in a neutral position, cortisone injections, and surgical release of the carpal tunnel ligament. Surgical treatment usually provides good and lasting resolution of the symptoms,⁷ but symptoms might take up to a year to completely resolve. Following surgery, there is an incision with sutures that are removed after two weeks, and sick leave is often required up to six weeks after the procedure, depending on the workload. For a working person, a diagnosis of CTS leads to a threefold increase in sick leave/disability pension days.⁸

HAND ARM VIBRATION SYNDROME

Hand Arm Vibration Syndrome (HAVS) is a cluster of symptoms and disability caused by vibration damage to various tissues. Vibration exposure might cause damage to blood vessels, leading to **“white finger disease”**, where the blood circulation to the fingers is impaired, causing pain and cold sensitivity.⁹ It might also cause damage to the nerves in the hand, causing neuropathy, which leads to impaired sensation of the hand, and increasing the risk of nerve entrapments, such as CTS.¹⁰ Vibrations may also cause damage to the muscle cells, causing weakness, and vibration exposure increases the risk of finger contracture (Dupuytren’s disease).^{11,12}



When blood vessels and nerves are affected, “white finger disease” may occur, and may be red and painful when blood circulation returns.



OTHER CONDITIONS

There is some evidence that work tasks that involve pinch grip might increase the risk of future osteoarthritis in the hand.¹³

IMPACT ON DAILY PRACTICE

WMSDs have both direct costs, in terms of seeking medical attention and compensation, and indirect costs, in the form of decreased productivity, lost wages, and reduced quality of life.

More recent data has shown 'Musculoskeletal disorders account for \$1 of every \$3 spent on workers' compensation for a total of more than \$15 billion to \$20 billion in workers' compensation costs.¹⁴ Dental hygienists reported a reduction in number of days worked, decreased speed and quality of work, and increased sick leave, and 18% to 30% of practitioners cited WMSDs as determining factors for quitting the profession.¹⁵

PREVENTION STRATEGIES

There are several strategies that the workplace can adopt to work proactively to prevent hand problems and disease among employees. Firstly, planning the workday and a smart design of the workflow, with reasonable work hours and patient load, as well as allowing for breaks between patients, are important strategies.¹⁶ It is also important that the equipment used allows sustainable working conditions, as well as providing education on ergonomics and avoiding awkward postures.¹⁵ Ergonomically designed instruments might help prevent hand and wrist disorders, and wide-diameter silicone handles may reduce hand and wrist pathology including hand fatigue.^{17,18} Stabilizing and supporting the hand when working in the mouth is also important to decrease the force needed in the pinch grip thereby reducing muscle fatigue.¹⁹ A simple chair-side stretching program, performed before starting a procedure, preferably developed together with a physiotherapist or occupational therapist, can also be effective in reducing hand fatigue.²⁰

The usage of loupes when appropriate is also important in preventing WMSDs.^{17,18}





Dental handpieces, high-speed turbines, and ultrasonic scalers expose the users' hands to high-frequency vibrations. Excessive vibrations from improperly maintained dental handpieces could result in the development of Hand-Arm Vibration Syndrome among dental practitioners. Dental handpieces that are not properly maintained throughout their lifetime are quite likely to develop a higher-than-normal rate of vibration. Used instruments are more hazardous as compared to newer ones. Rotating instruments such as high-speed turbines and handpieces must be replaced periodically, sufficient to switch between two operations, especially after every handpiece usage.^{21,22}

Clinical evaluations have demonstrated that cleaning and lubrication are the most critical factors in determining performance, durability, and longevity.²³

Supportive workplace policies that facilitate return to work for the employee help minimize sick leave and time away from work.²⁴ Someone who is newly operated for CTS might be able to return to work faster if there can be an adjustment of work tasks, for example, by shifting from clinical to administrative work during the first recovery period after surgery (once the sutures are removed).

For the individual, having optimal treatment and control of eventual medical diseases, such as diabetes and obesity, is of importance, as they might further increase the risk of MSDs such as CTS. Diabetes is a common condition that increases the risk of CTS, and optimal blood glucose control helps reduce the risk of developing CTS. Physical exercise is also effective, in preventing other medical comorbidities, as well as WMSDs.

GLOVE SELECTION

For gloved tasks, glove selection impacts symptoms of hand fatigue, and may also impact the pressure inside the carpal tunnel. Too small gloves and incorrectly fitted double gloves (which sometimes are needed when performing surgery where there is a risk of glove perforation) increase the pressure inside the carpal tunnel more than a single glove of the right size.²⁵ For longer gloved tasks, it might be beneficial to choose fitted gloves. These gloves are molded for a left and a right hand, whereas ambidextrous gloves have a fit for either the right or the left hand. Ambidextrous gloves stretch more and exert greater force when worn. This could lead to impaired blood flow, nerve compression, muscle fatigue, and hand pain.²⁶ Glove thickness also impacts hand function, where a thicker glove decreases tactile sensitivity.²⁷ For invasive tasks when double gloving is warranted, a thick outer glove reduces the tactile sensitivity without increased protection in the event of a sharps injury. A dedicated colored underglove for perforation detection with a standard thickness (or micro-thin) top glove is recommended.²⁸

Hence, it is important to choose gloves of the right size, as thin as possible, and fitted gloves are probably better for tasks where the gloves have to be worn for a longer period. There are ergonomically certified gloves available with the intention to reduce muscle effort during daily wear and reduce hand fatigue.



QUALITY REQUIREMENTS, EVALUATION, AND PURCHASE

When choosing gloves, it may be valuable to know that gloves intended to be used in medical/dental procedures, must fulfill Medical Devices Regulations. These strict rules are intended to ensure that all patients, staff, and others involved are guaranteed care will be provided with the best possible quality and the greatest possible safety, at a reasonable cost and with as few risks and side effects as possible. Environmental aspects and sustainability should also be considered when choosing gloves for one's practice.

Medical Devices Regulations have the following specifications:

- EU: MDR 2017/745;
- Australia: MDR 2002;
- Brazil: RDC 16 2013;
- Canada SOR 98-282;
- Japan: Japanese Medical Device QMS;
- USA: 21 CFR 803, 21 CFR 806, 21 CFR 807, 21 CFR 820, 21 CFR 821.

This includes a Declaration of Conformity (DoC), a legally binding document where the producer certifies the fulfillment of current requirements in international standards.

- EU 2016/425 Personal Protective Equipment;
- EN-ISO 21420:2020 Protective gloves - General requirements and test methods
- EN-ISO 374-1 Protective gloves against dangerous chemicals and micro-organisms
- EN-ISO 374-5 Penetration resistance, microorganisms - bacteria, virus, and fungus

- EN 16532:2015 Determination of material resistance to permeation by chemicals - Part 1: Permeation by potentially hazardous liquid chemicals under conditions of continuous contact. Breakthrough time.
- EN 421:2010 Protective gloves against ionizing radiation and radioactive contamination

All these regulations serve the sole purpose of ensuring that all medical devices are produced in a safe process and are safe for everyone: staff, patients, technicians, and others.

In continuation, all these requirements must not only be met by manufacturers but must be maintained: validated, verified, and process-controlled by users and technicians throughout the whole lifetime (cycle) of the medical device (product). By international standard ISO 13485:2016 - Medical Devices, Quality management systems - manufacturers are obliged to implement Post Market Surveillance concerning their medical devices. Including not only the above-mentioned quality aspects and standards but also identified, suspected, and/or previously unknown risks and side effects such as the correlation between medical/dental gloves and work-related musculoskeletal disorders.

In conclusion, awareness needs to be raised for WMSDs of the hand in dentistry, and there are today already effective prevention strategies that can be applied. Further research needs to be done to further improve the work environment, equipment, and gloves to allow all practitioners a long and healthy career.



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