

Description of a measure to facilitate a neutral working posture: the use of the headrest.



Jacqueline J.A. Bos-Huizer.



BBO-ergo | Kanaaldijk Oost 5 | 3621 LL Breukelen
+31(0) 346 216 926 | info@bbo-ergo.com
bbo-ergo.com

Jacqueline Bos, physical therapist and ergonomist, established BBO-ergo in 2005. BBO-ergo provides training courses in ergonomics in the workplace and assists in designing or adapting workplaces. BBO-ergo is specialised in dental ergonomics, veterinary ergonomics and ergonomics for medical specialists. Jacqueline lectures nationally and internationally on dental ergonomics and the specific aspects for dental specialisations such as endodontics, periodontics, orthodontics, pediatric dentistry, microsurgery and dental hygiene.

Jacqueline's mission is to teach people to work in a healthy manner. Thanks to her background as a physical therapist, she is able to give participants a real experience in working comfortably, healthily and efficiently.

1. Abstract.

Dental professionals worldwide suffer from musculoskeletal disorders (MSDs). During their educational training, dental hygiene and dental students already suffer from pain and tiredness even before starting their professional career. Dental professionals as well as dental students work in awkward body positions. However, being aware of this does not correlate with better ergonomics. Dental professionals experience pain and discomfort as 'part of the job' and there is a lack of knowledge of the ergonomic requirements when choosing new dental equipment.

Working from neutral body postures is a preventive measure against MSD. This should be facilitated by the use of dental equipment. An example of an ergonomic measure consists of the use of the headrest. This article describes how to use the headrest correctly to achieve optimal access and visibility of the patient's mouth, while also ensuring comfort for the patient.

2. Introduction.

According to scientific literature, the dental profession is one of the most susceptible to occupational diseases. Musculoskeletal disorders (MSDs) refer to disorders affecting bones, muscles, and joints usually caused by prolonged static postures¹. Over the years, numerous studies have been conducted to investigate the prevalence of MSD, and the prevalence of MSD in dentistry remains high. The Dental professions are at risk of MSD, with alarmingly high prevalence rates of up to 96%, which are on the rise for all types of dental professionals. In spite of different patterns of work culture, there are comparable symptoms in dentists across nations. Symptoms appear very early in careers, with higher prevalence of MSDs even during educational training².

Risk factors for MSDs are multiple, including static and awkward postures (particularly in relation to neck and shoulder conditions); repetition and force (more commonly related to hand and arm conditions); poor lighting (both for intensity and positioning); improper positioning of patient and dental worker; individual characteristics (physical condition, height, weight, general health, gender, age) and stress³.

3. When do dental professionals start to develop MSDs?

In a study among Australian dental hygiene and dental students during their first and final year of education, 84,6% of those surveyed were found to suffer from MSD associated with the clinical requirements of their training⁴. This finding is consistent with previous studies involving dental students. Another study among Iranian dental students reported that 82% of undergraduates and 90% of postgraduates report pain in at least one body region⁵. These findings suggest that oral health professionals may have an increased risk of developing MSD during their education and training, well before the beginning of a professional career.

For example, the prevalence of 'any neck symptoms' for dental hygiene students in the study among Australian students⁴ was reported to be 33,3% during their first year of education and to have risen to 68,8% in their last. The same study reported that 'lower back pain persisted for more than 2 days' for 50% of the dental students during their first year of education, and rose to 62,5% during their last.

The increase in neck pain prevalence is similar to that of a previous study of dental hygiene students that recorded increasing neck pain as they progressed through the course⁶. This may be the result of increased clinical hours students have to complete in their final year.

Recent studies also assessed students' body postures during work. From a sample of 138 students, the posture assessment revealed that 61% presented scores classified as not acceptable⁴. Notably, students from the 4th year dental studies group had the most unacceptable body postures. It suggests that the work posture deteriorated over the course of years. This places this group at the greatest risk of cumulative trauma disorder.

In another study among undergraduate dental students (4th and 5th academic year) in Iran, a risk assessment of MSDs was performed by observing postures: 66% of dental students were within risk levels, meaning that if the observed postures continued, they would be at an intermediate to high risk of developing MSD symptoms¹. This finding is consistent with previous studies.

In addition to posture observations, this study also measured awareness levels concerning neutral body positions. The average awareness and MSDs risk levels among these students were shown to be unsatisfactory; there were no significant correlations between the two. In other words, students with a higher awareness of ergonomics had not necessarily adopted a healthier posture. This indicates that awareness alone does not sufficiently affect their behaviour. It can thus be said that theoretical instructions are insufficient. Adopting a correct posture and maintaining it during operating time is a skill rather than a cognitive matter. A number of factors contribute to adopting a non-neutral posture during dental operations: unfavourable positions of the patient and instruments table, lack of ergonomic equipment, lack of assistance. Therefore, authorities should provide students with proper ergonomic equipment and facilities¹.

4. Developing MSDs during the dental worker's career.

Dental professionals start to work clinical hours during their education. From this moment, they already experience pain and tiredness in certain body regions. And it is from here that awkward body postures are observed.

Meanwhile, the job needs to be done. Students want to learn to perform their job correctly. It is clear they do not know how to work while remaining in a neutral body position and at the same time having optimal access and visibility of the patient's mouth. So in fact, they have no other choice than to ignore these physical symptoms while performing their tasks. The physical symptoms are already accepted as 'part of the job' early in their career. Students experience pain and tiredness during and/or after working clinical hours. In the beginning of their career, these symptoms will disappear immediately or soon after completing the task. After several years of working and increasing clinical hours, dental students will experience that pain fails to disappear immediately after work. Students might experience some pain and discomfort during the hours after work, but they will recover during a good night's sleep and start the next day without any pain. In the next stage, a night is not enough to recover fully. They will start the next day with symptoms left from the day before. Furthermore, during the day these symptoms will worsen. The older one gets, the longer the body needs to recover from physical load. Usually somewhere around the age of 40, people start to experience changes in the human body's recovery time. In the next phase, a weekend is not enough to recover from the occupational load and finally even a vacation will not bring them back to having no physical complaints at all. This is the stage of chronic pain. At this stage, disabilities will probably appear and can be the reason why dental professionals decide to work less clinical hours. This is usually the moment when people become highly interested in dental ergonomics.

5. The influence of dental equipment on body posture.

Young dentists tend to work with the equipment that the predecessor left them. In the early stage of their career, they usually lack the financial means to design an ideal dental office. They start to work with the predecessor's equipment. Without being aware of it, they can be forced into uncomfortable positions and develop MSDs. In particular, dental professionals that are smaller in stature are at a greater risk precisely because, due to their height, the equipment forces them to work in uncomfortable positions.

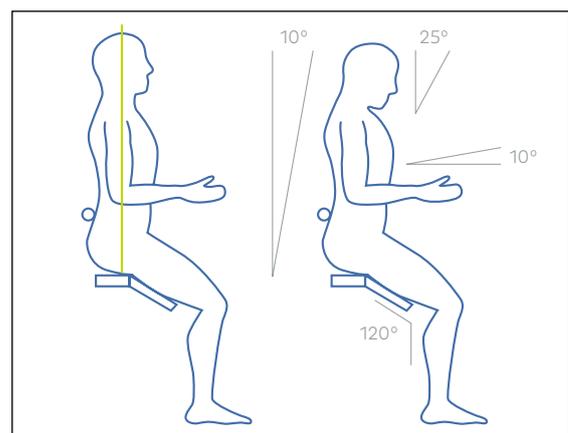
In addition, there is a lack of knowledge among dental professionals when it comes to buying new equipment. Dental professionals often wish to improve the workplace for purposes such as ergonomics, efficiency and/or to carry out four-handed dentistry. However, they are unfamiliar with the ergonomic requirements they need from their equipment. Although this information is already available from 'The ergonomic requirements for dental equipment' ⁷, this is unfortunately not common knowledge yet.

6. Starting point of view: a neutral body position.

Dental professionals often work in bent over and twisted postures. Furthermore, they use high arm positions. Working like this for long periods of time causes muscle fatigue and places tendons and ligaments under pressure. If someone works for more than four seconds continuously in a certain position, static burden limits the bloodflow and, in doing so, the transportation of nutrients and waste substances. This static burden particularly increases the risk of MSDs. To limit the physical strain to a minimum, it is important to work from a neutral body posture as much as possible. A neutral body posture for dental professionals is described in ISO 11226⁸, Hokwerda⁹ and outlined in the checklist "Working ergonomically in dentistry"¹⁰.

Sitting working posture dental professionals, according to ISO 11226.

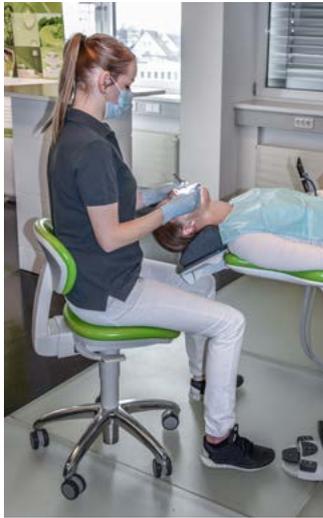
- Natural S-curve of spine, no C-curve
- Knee angle of 110-120°
- Feet flat on the ground, underneath the knees
- Feet directed forward in line with the upper legs
- Legs slightly spread
- Neck flexion max. 25°
- Body flexion with S-curve of spine, max. 10°
- Upper arms next to the body, max. 20° lifted
- Forearms raised 10-15° above the horizontal, max. 25°
- Elbows in the middle position: avoid extreme pro- and supination
- Wrists in the middle position: avoid extreme wrist postures
- Symmetric body posture: eyes, ears, shoulders, elbows, hands, hips, knees and ankles on parallel lines



Picture 1: Optimal upright position according to ISO 11226.

For more information download
the BBO-ergo checklist
"Working ergonomically in dentistry"





Picture 2: Neutral working posture facilitated by optimal working area positioning.

In addition to these guidelines, the frequency and duration of postures also defines the physical load borne during the working day. Roughly one can work with the 80/20 rule: when 80% of time the work is carried out from neutral positions, during the remaining 20% of time adjustments can be made. If working in a neutral position is not possible, the dental worker should be aware when working in an uncomfortable posture, limit the duration of time, and go back to a neutral position as soon as possible.

To be able to work from neutral body positions, one should take measures to facilitate this. These measures concern the workplace, for example the kind of equipment; the way the work is carried out, namely body and equipment handling; and the organisation of the working area, diary planning, four-handed dentistry, breaks etc. Many measures can be adopted to achieve healthy and comfortable working. One of them concerns the use of the headrest. If the headrest can be an effective measure, how should it be used in practice so that it supports the occupational health of dentists? How can the dental practitioner work more effectively and accurately using the headrest, enhance a neutral working posture and still have optimal visibility of the patient's mouth (picture 2)?

7. Ergonomic measure: use of the headrest.

In the workplace, the dental unit plays a key role in influencing body posture and therefore the physical load. There are many different dental units on the market and unfortunately the optimal ergonomic unit does not yet exist. To be able to choose the best unit available for a dental worker, knowledge and insight of the requirements are necessary. In addition, having an ergonomic unit does not automatically mean someone works ergonomically. One should learn how to use the equipment properly to facilitate working from neutral body postures.

The headrest is a very important part of the dental unit for two reasons: it affects the position of the working area (the patient's mouth) for optimal visibility and access, and at the same time it provides a comfortable support for the patient's head and neck. Creating optimal visibility while the patient complains about discomfort in the neck will not constitute a constructive measure for working comfortably.

There are different headrest adjustments to be made when working in the upper and lower jaw.

Upper jaw settings.

For treatment in the upper jaw, as one is working with indirect visibility and approaching the patient from the back, the patient's head needs to be tilted backwards. For optimal visibility of the upper jaw, the occlusal planes should have an angle of 20° behind the vertical. It is very important that the patient is comfortable in this position. To achieve this, the patient's neck needs to be supported properly. When supporting the neck, one should avoid a firm support high in the patient's neck (region os occipitale-C1-C2), as this is the location where the neck has to make the backwards movement. Although for some patients this firm and high support feels comfortable, it is a barrier to properly positioning the working area. The neck should be supported around the contours. The patient should feel it is supporting, not too hard, not too soft, comfortable and gentle. The pictures show the KaVo double-jointed headrest with pneumatic clamp with the comfort head cushion attached instead of the normal upholstery.

Dental Ergonomics.

This headrest and comfort cushion provide optimal positioning and support for the patient's head and neck. The headrest has a thin and flat base on which a separate cushion is placed, connected with a magnet. The cushion is made of memory foam and the design fits the curvature of the patient's neck. Because the cushion can move freely in any desired direction, it can easily be optimally positioned underneath the patient's neck.



Picture 3. Occlusal planes upper jaw 20° behind the vertical, while the patient's head and neck are optimally supported.



Pictures 4 and 5: Neutral body postures, optimal visibility and access to the upper jaw for both dentist and assistant.

Communication.

Be aware of the fact that positioning the patient's head backwards is probably not what patients are used to when lying in the dental chair. Good communication is therefore important: inform the patient that this setting is necessary to be able to see and therefore work properly. In any case, not every patient can be positioned this way, for example patients with arthritis or older patients are not advised to bend the neck backwards.

Upper jaw positioning and dental microscope.

There is one exception when working with a dental microscope in the upper jaw: an angle of 90° related to the horizontal will be enough to achieve optimal visibility of all elements of the upper jaw, in the same way as working with a mirror. This 90° angle is sufficient because of the construction of the microscope: its body is positioned above the patient's mouth and the distance from the dental worker's eyes to the microscope's body is covered by the binoculars. This exception is unsuitable when working with loupes.

Common mistake.

The most common ergonomic mistake in dentistry is when a vertical position of the occlusal planes or an 80° angle related to the horizontal is adopted. In these positions, dental professionals need to bend forward to gain optimal visibility, and even when working with indirect visibility, keeping a neutral body position will not be possible. Furthermore, in order to work in the patient's mouth, the arms need to be raised too high.

Dental Ergonomics.

Indirect vision.

When the occlusal planes of the upper jaw are 20° behind the vertical, one can easily see and reach all elements in the upper jaw while remaining in an upright position. Remember that this can only be possible, when working with a mirror. Working without a mirror will always cause a-symmetric uncomfortable positions.



Picture 6: The occlusal planes of the upper jaw 20° behind the vertical provides optimal visibility of all elements when working with a mirror.

Lower jaw settings.

When working in the lower jaw, with the patient's body positioned horizontally and approaching from the back, the patient's head needs to be tilted forwards. The occlusal planes of the lower jaw make an angle of 45°. When working in the front parts, the occlusal planes need to be flatter, about 40°, and when working in the last molars they need to be steeper, about 50° related to the horizontal. The exact angle of the occlusal planes is defined by optimal visibility from a neutral working posture, depending, for example on mouth opening and position of the elements, so fine-tuning is important.



Picture 7: Occlusal planes lower jaw at 45° angle with optimal support of the patient's head and neck.



Pictures 8, 9, 10: Neutral body postures, optimal visibility and access on the lower jaw.

Mirror and magnification.

When working with a mirror in the lower jaw, some adjustments need to be made in positioning the patient's head. Mostly, the angles are steeper, usually an angle of around 70-80° provides optimal visibility when working from a neutral body position.

When working in the lower jaw, approaching the patient from the side (sit location 9 or 10 o'clock), the occlusal planes need to be as flat and horizontal as possible. By rotating the patient's head towards the dental worker, perpendicular visibility on the occlusal planes is possible. The positioning of the lower jaw is not different, when working with a microscope or loupes.

Fine-tuning for optimal visibility of upper and lower jaw.

To achieve further optimal visibility of all parts of elements in both the upper- and lower jaw, one can use the possibility of rotating the patient's head. After placing the headrest in the optimal position for working in the upper or lower jaw, fine-tuning needs to take place: when rotating the patient's head to the left, one can easily see and access the buccal parts of the 1st and 4th quadrant, the palatal parts of the 2nd quadrant and the lingual parts of the 3rd quadrant. When rotating the patient's head to the right, one has optimal visibility and access to the palatal parts of the 1st quadrant, buccal parts of the 2nd and 3rd quadrant, and lingual parts of the 4th quadrant. When working with a mirror, it is necessary to rotate the head in the opposite direction as described above.

8. Summary.

Dentistry poses a great challenge because the ergonomics of dental work is difficult. Ergonomics seeks to reduce cognitive and physical stress, prevent occupational diseases related to the practice of dentistry and improve productivity, with better quality and greater comfort for both the professional and the patient². Considerable efforts have been made in recent years to improve ergonomics in dentistry, for example, the implementation of standards and guidelines for ergonomics in clinical care and the manufacturing of dental equipment. To be able to work from these standards, a mental shift needs to take place: instead of adjusting the dental worker's body posture to achieve the best visibility, the starting point of view is a neutral body position. To achieve optimal visibility, one should present the work optimally and in this way facilitate a healthy way of working. One measure described in this article is the use of the headrest. This measure is important in positioning the working area properly when operating in the upper or lower jaw, while keeping an upright body posture. When performed properly, headrest positioning will bring comfort to both the dental worker and the patient.

Dental professionals will experience the difference after a day at work. Working from neutral body postures can be hard in the beginning. As most dental professionals are unfamiliar with it, training might be necessary: awareness as well as physical training. When making these changes, the stages of behaviour change and the effort experienced during this learning cycle can be hard and even tiring in the beginning. Professional on the job coaching specialised in dental ergonomics is advised. When changes are effective and structural, dental professionals are able to, steadily, achieve a healthy way of working.

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The opinions expressed in this article are those of Jacqueline J.A. Bos-Huizer. KaVo is a medical device manufacturer and does not dispense medical or ergonomic advice. Clinicians should use their own professional judgment in treating their patients and observing measurements to facilitate a neutral working posture.