

## Commentary

# Caring for the Neck and Posture in Dentistry: Better Late Than Never



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## Background

Work-related musculoskeletal disorders (MSDs) are described as a group of injuries or diseases of the nerves, muscles, tendons, bones, joints, cartilage, and intervertebral discs related to high levels of exposure to physical factors at work. They are responsible for one of the greatest loss of productive life years, which commonly results in early retirement by limiting physical, mental, and functional abilities.<sup>1</sup> Dentists are at increased risk for work-related MSDs, which can ensue due to repetitive unnatural motions and improper postures for extended periods of time.<sup>2</sup> These MSDs influence the dentists' daily and professional lives and require more than one-third of them to seek medical attention.<sup>3</sup> Although MSDs and their impacts have been reported in the literature, they still remain a common outcome of poor working posture amongst dentists. Therefore, this commentary highlights the importance of working posture and work-related MSDs—especially neck problems—in dentistry.

## Introduction

Dentists are prone to many risk factors for chronic neck, upper and lower back, and shoulder pain. A systematic review and meta-analysis including 30 studies showed that the frequency of MSDs and pain ranged from 11% to 98% amongst dental professionals and neck (58%), lower (56%) and upper (41%) back, and shoulder (43%) were the most commonly affected regions.<sup>4</sup> The prevalence of neck disorders in dentists has been reported as 57% in Australia, 56% in Poland, 52% in Iran, 51% in the Netherlands, and 20% in Saudi Arabia.<sup>5</sup> Although dentists are often seated, their job requires working in a poor posture, that is, bending over a patient who is prone to gain access to the limited intraoral area during the entire procedure, burdening their spine, periscapular muscles, rotator cuff tendons, and upper extremity musculoskeletal structures (Figure). The most important part of ergonomics

suggests that the correct posture is seated in a neutral position without muscle tension. However, this abnormal and prolonged static posture (forward head, loss of cervical lordosis, shoulder protraction, and thoracic kyphosis)—being held for >4 to 30 seconds<sup>6</sup>—is often needed in daily clinical interventions to gain better visibility for excellent hand dexterity and optimal eye-hand coordination. In female dentists, inclinations and movements of the head for a mean duration of 13 to 17 minutes of work have been recorded whereby the head was shown to be tilted forward during half of the time  $\geq 39^\circ$  and during 10% of the time  $\geq 49^\circ$ .<sup>7</sup> Recently, Katano et al.<sup>8</sup> found that the direct view technique required the dentist to tilt the head  $>65^\circ$  and to tilt the body 20 to  $25^\circ$ ; however, with the mirror view technique, these angles reached up to  $38^\circ$  and  $5^\circ$ , respectively. Although neck flexion improved with the mirror view technique, it is still greater than the suggested ergonomic values (ie, neck flexion of  $>20^\circ$ ), which imposes an important problem for the cervical spine among dentists.<sup>9</sup>

## Discussion

Normally, there are 4 interdependent curves in the spine: lordosis in the cervical and lumbar regions and kyphosis in the thoracic and sacral regions. When these curves are balanced against the centre of gravity, the spine is supported mainly by the vertebrae. If these curves increase or flatten, the spine mostly depends on the muscles, tendons, ligaments, and other soft tissues to support the erect posture. Forward-head posture is common in dentists due to poor working posture to gain better visibility during interventions (Figure). In this posture, the vertebrae cannot support the spine properly, and the postural muscles (of the neck and back) must contract repetitively to carry the weight of the head against the gravity. This may result in axial neck pain, often called “tension neck syndrome,” which can cause chronic pain in the posterior head, neck, and periscapular muscles, and it can also



**Figure – Examples of working poor postures in dentistry. Forward-head posture (A) and forward-right neck position (B).**

(rarely) radiate into the shoulder and/or arms.<sup>10</sup> Poor posture and multiple extreme positions of the neck may increase the risk of cervical disc degeneration, herniation, and spondylosis. It has been found that prolonged static posture may predispose dentists (especially younger dentists) to cervical intervertebral disc herniation, with an incidence of 1.1% during a 5-year follow-up.<sup>11</sup>

Intervertebral discs are avascular, and their nutrition is dependent on diffusion from the vessels at the disc's margins. If the load on the disc is high, the tissue liquids (carrying nutrition) tend to flow out from the disc. If the load is low, the liquid flows into the disc.<sup>12</sup> Therefore, a periodic change of the disc load is essential for nutrition and also for resistance against pathologic changes. The periodic change (during posture alterations between leaning forward and reclining positions, whenever possible) between high and low loads of the disc provides an effective pump mechanism. Movement stimulates the pump mechanism to nourish the intervertebral discs, but nutrition to the discs is reduced and degenerative changes occur under prolonged static posture.<sup>13</sup> Therefore, an optimal sitting position “as upright as possible” has gradually switched over to the concept of “dynamic sitting.”<sup>13</sup> For this reason, dentists should move more during their working hours in a proper and safe range of motion. Further, relaxing and strengthening of the postural neck and back muscles and stretching the neck flexors and pectoral muscles for maintaining cervical lordosis in the proper posture (ie, ear above the shoulder) during all activities of professional and daily life (eg, working, sleeping, reading, driving, and using a computer or smartphone) is vital for cervical spine health.

Cervical intervertebral disc degeneration/herniation is a common cause of cervical radiculopathy causing neck, shoulder, and arm pain with neurologic deficits. An epidemiologic study has shown that population incidence of cervical radiculopathy was reported as 83/100,000 in a year, which peaks in the 4th and 5th decades.<sup>14</sup> The C7 nerve root is most commonly affected, followed by nerve roots of the adjacent

segments (ie, C6 and C8).<sup>7</sup> Risk factors include age, race, genetics, lack of exercise, smoking, poor posture, work/manual labour (eg, dentistry, surgery), lifting heavy objects, operating vibrating equipment, playing golf, and even frequent smartphone use.<sup>11,14,15</sup> If conservative treatment fails or progressive neurological deficit occurs, surgery might become unavoidable. Cervical pain and radiculopathy rank 4th in the burden of disease,<sup>16</sup> and the need for surgery has increased substantially over the last decades; for example, about 132,000 anterior cervical discectomy and fusions are performed every year in the United States.<sup>17</sup> Although the overall outcome of surgery (eg, pain intensity and neurologic deficits) is good in about 80% of cases, when more functional tests were evaluated, the results were less satisfactory.<sup>18</sup> Beyond potential surgical complications, more than one-third of patients still continue to experience chronic neck pain and deficits including limited range of neck motion and weakness in the neck and upper limb muscles.<sup>18</sup> In addition, symptomatic adjacent segment degeneration develops in up to 25% of patients after fusion surgery within 10 years, necessitating revision surgery.<sup>19</sup>

The cervical spine has the highest range of motion in the spinal column, and it is also unique in its normal kinematics with up to 90° of flexion, 70° of extension, 45° of lateral flexion, and 90° of rotation.<sup>20</sup> Of note, dentists flex their trunk  $\geq 30^\circ$  (more than half the time) and neck  $\geq 30^\circ$  (85% of the time).<sup>21</sup> Neck flexion angles  $\geq 20^\circ$  induce severe stress on the neck, and angles  $\geq 45^\circ$  are categorised as harmful according to the adapted version of the Posture Assessment Instrument.<sup>9</sup> Therefore, the flexion angles depicted by Katano et al.<sup>8</sup> emphasise the excessive neck flexion posture during tooth preparation. When the angle of the back is decreased to correct the posture, the neck flexion is increased to provide vision. As such, the indirect mirror technique should practically and necessarily be taught to dental students, starting with preclinical education with simulators, for impeding the early acquisition of poor postural habits.

Since the forward-right neck position is the most common position (Figure),<sup>22</sup> and the neck is the most commonly affected body region<sup>4</sup> amongst dentists, it is important to prevent excessive neck flexion during dental procedures.<sup>23</sup> Although some studies on the use of ergonomic saddle seats and dental loupes to improve excessive neck and trunk flexion postures exist, their effects on neck pain are limited.<sup>23</sup> Accordingly, it is suggested that customised soft cervical collars should be used to protect the cervical spine in dentistry by providing awareness and acting as a reminder (kinaesthetic effect) to avoid excessive head/neck motions.

Soft cervical collars limit neck movements poorly in all planes <20%, but neck flexion beyond 45°—the worst posture leading to neck pain and disc degeneration—cannot be performed easily. As the commercial products may cause discomfort (eg, skin irritation, pain) due to improper fit, designing a customised, lightweight, and aesthetic collar may be useful.<sup>11</sup> Yet, a customised cervical collar has been shown to significantly decrease the degree of neck angle during smartphone use.<sup>15</sup> As a large majority of dental students are being affected by musculoskeletal pain during their undergraduate training, many dental schools have already applied dental ergonomics in their curricula. However, knowledge and awareness regarding ergonomic training are still lacking in some dental faculties.<sup>24</sup> Therefore, undergraduate education about musculoskeletal health and dental ergonomics, with clinical supervision of dental students, is essential for preventing MSDs.

## Conclusions

Dentists may ignore the above discussion and issues in the beginning of their careers as they may not have experienced neck or back pain. However, raising awareness about potential future neck and back problems is essential for adoption of appropriate posture. Likewise, correct posture can be supported in a number of ways, such as using posture reminding apps or a soft cervical collar to prevent hyperflexion; using a magnification system, especially for endodontics due to very limited working area (pulp chamber) and close focus; using a saddle style operator stool; working alternately between dynamic sitting and standing, and proper patient positioning. Moreover, strengthening and stretching exercises of neck and back muscles can also promote pain-free career. As dentists are prone to lose their flexibility in the opposite direction that they are postured statically during their work, stretching exercises should be performed in the opposite direction of the awkward posture to prevent muscle imbalances.<sup>10</sup> They should also perform certain strengthening exercises for the neck, shoulder girdle, and trunk to enhance the musculoskeletal integrity/health of the spinal column. Last but not least, prevention is always easier, less expensive, and better than treatment, especially for the most important (ie, cervical) part of the spine.

## Conflict of interest

None disclosed.

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