Maintaining a Balanced Posture by Dentists—A Challenge of the Current Practice

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Abstract: (1) Background: Dentistry is acknowledged as being particularly physically demanding, considering access difficulty and visibility of the operating field. The issue of posture is frequently discussed in the literature due to its significant contribution in the etiology of musculoskeletal disorders, but never enough to encourage all dentists to adopt safe, healthy working positions. (2) Methods: This article presents the arguments that justify the attention needed to be paid to the balanced posture recommended to dentists and goes further and outlines a logical model that could help in maintaining a balanced posture as much as possible during the therapeutic act. Describing the balanced posture alone has a limited practical utility, and thus we have detailed the aspects that involve the spatial relationship of the doctor with the patient sitting on the dental chair. (3) Results: An optimal working distance and postural symmetry are the main objectives to be considered, each of them being conditioned by several elements. These elements have been detailed throughout the article, always taking into account the realities of the daily practice, with its challenges and limitations. (4) Conclusions: A greater attention paid to maintaining the optimal working position provides doctors the chance to perform their activity in comfortable and safe conditions.

Keywords: ergonomics in dentistry; balanced posture; optimal working distance; postural symmetry

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Introduction

Dentistry mainly involves performing surgical operations on small structures difficult to access, which require very good visual control and high precision while working with cutting instruments. It is not easy to achieve all these goals at the same time; thus, working in the oral cavity is a challenge, and this performance is only achieved after many years of training. Dentists are able to meet these requirements due to the increased
attention and concentration involved in the activity and due to the skills developed through continuous training and practice. Beyond these objectives, the need for the doctor’s comfort emerges, because no activity of such finesse and precision, often performed for a long time, can be accomplished in a state of physical and mental discomfort of the operator. Physical comfort is largely determined by the posture adopted by the doctor while working; therefore, it is worth paying attention to this topic.

Posture, as a notion used in ergonomics, is the placement of the body segments of a person performing an activity. A “good” posture should provide the doctor with more energy for work, reduced physical and mental stress, increased comfort, lack of pain and muscle tension, intra-operative stillness and a reduced risk of errors. A “bad” posture leads to premature fatigue, stress and a negative attitude, discomfort, pain, high risk for musculoskeletal disorders and thus reduced quality of work [1]. The posture of the dentist is a subject discussed carefully through university, and furthermore through post-university, courses that discuss ergonomics issues; nonetheless, many doctors do not fully understand its utility for practice.

The difficulties of working in a “bad” posture and the perspective of musculoskeletal disorders caused by it should make doctors pay attention to this matter and adopt changes in order to correct their posture and compensate for the negative effects of bad postures. Musculoskeletal disorders (MSDs) are disorders of the muscles, joints, ligaments and nerves caused by the working process or the working environment [2]. Various studies show a high prevalence of musculoskeletal disorders among dental professionals. In the recent literature, we have found global values of prevalence for groups of different types of musculoskeletal disorders or values of prevalence for the most affected body segments: neck, shoulders and back. As global values, we have found similar percentages, with a prevalence of 76.2%, 78% and 81.4%, respectively [3–5]. One report showed the following values of prevalence for different body segments: neck—58.5%; lower back—56.4%; shoulders—43.1%; and upper back—41.1% [6].

The real challenge of daily practice is not adopting a balanced posture, but to maintain it throughout the various daily demands of dental practice. In other words, it is not difficult to sit correctly on an ergonomic chair, specially designed for doctors, to make all the necessary adjustments and thus to adopt a balanced posture, as long as you do not interact with the patient and the elements of the workstation (dental unit, equipment, furniture). The interactions with the patient and the equipment necessary for work most often lead to the adoption of dysfunctional postures that can be maintained without great difficulties and very serious consequences only for a short period of time. For laborious, difficult procedures that require a longer working time and maximum concentration, the comfort of the doctor and the attention paid to the working position become especially important.

This article discusses the postures adopted by dentists starting from the balanced posture and presents solutions for maintaining it throughout the therapeutic act. Unfortunately, many of the articles and approaches to the topic of balanced posture are limited to presenting the characteristics of the balanced posture and describing the unfavorable consequences, in the short and long term, of the impossibility of maintaining it. This limited approach of the topic usually transforms the balanced posture into a goal that is beautiful but impossible to achieve. We asked ourselves the following question: What are the missing links in the path leading from theory to practice? In other words, what other important elements, beyond theoretical knowledge, condition the preservation of the balanced posture after it has been adopted? This article focuses on these missing elements, and we hope to help dentists understand the concept of balanced posture and introduce it to everyday practice.
Materials and Methods

The presentation of the notions in this material has an analytical character, starting with the general aspects regarding the correct posture recommended to dentists and its advantages, and continuing with the elements that influence and bring alterations to it in everyday practice. The presentation is logical and concise so that the road from theory to practice can be easily followed by dentists seeking improvement in their ergonomic working style.

Results

There are two main postures of the dentist: the orthostatic posture and the sitting posture. They are used in daily practice in different situations generated by specific working conditions; each of them can be discussed and analyzed from an ergonomic perspective. We can analyze the situations and conditions that require a certain posture, whether they depend on the operating act or the organization of the office and the activity, as well as the advantages and disadvantages of the two postures when considering the consequences on the doctor’s health.

The orthostatic posture and the sitting posture differ by a number of aspects:

- The level of physical strain they demand and energy consumption—both higher for the orthostatic posture;
- The degree of balance, stability and precision of the movements—higher for the sitting posture;
- The degree of dynamism allowed (freedom of movement)—higher for the orthostatic posture.

The orthostatic posture maintained for a long time has the major disadvantage that it involves a “fight against gravity” and, in addition, can lead to deformities of the skeletal system (flattening of the sole of the foot, deformities of the spine), disorders of the vascular system, dysfunctional phenomena of the various organs, etc. Due to the predominant right side bending of the doctor, the orthostatic posture is most often an unstable, asymmetrical and unbalanced posture. This posture is recommended only as an alternative to the sitting posture, for short and simple therapeutic acts, or after an operating act that involved maintaining the sitting posture for a long time.

The sitting posture recommended to dentists for most therapeutic acts has been called a balanced or neutral posture.

The Balanced Posture

The balanced posture or the correct, “good” posture, recommended for dentists, is a topic frequently discussed in the literature. This subject is often analyzed starting from the correct sitting posture on a chair (described in general ergonomics) and then differentiated in relation to the particularities of dentistry. The subject is of great interest due to the fact that a correct posture is difficult to maintain while working, and as a result, we often see dentists working in unbalanced, incorrect, “bad” positions. The causes for adopting these postures are multiple: working habits and routine, intense work pace, lack of space, lack of knowledge, resistance to change, lack of help from the medical assistant, ignoring the discomfort during work and, last but not least, ignoring their unfavorable consequences on work quality and personal health.

The working posture recommended for dentists is a sitting posture, described in “ISO Standard Ergonomics—Evaluations of static operating postures”, called the balanced or neutral posture. The balanced or neutral posture represents a reference element for the correct working posture, and it is recommended to be maintained, within the limits imposed by the practical work requirements, throughout the operating act. The
notion of “neutral” derives from the fact that each joint of the body has a neutral area to which movements are related and which, when repeatedly and continuously forced, generates joint and muscle overload [1].

The essential and defining characteristics of a balanced posture can be summarized as follows:

- Balanced posture is a natural, comfortable, unforced and non-stressful posture for the osteo-muscular-articular system, and it respects the physiological limits of the human body;
- Balanced posture is a comfortable posture due to minimal muscle contractions and stretches;
- Balanced posture is a stable posture due to the large support surface of the body on the chair, the firm support of the bodily segments and the possibility of stabilizing the joints during work;
- Balanced posture is a symmetrical posture, which ensures a balanced muscular and articular load of the two parts of the body, right and left.

Balanced posture description (Figure 1):

- Straight back and respect the symmetry; avoid rounding the back in the shape of the letter “C”.
- Anterior tilt of the torso of maximum $20^\circ$; a greater inclination, lateral inclination and torso rotation are not recommended.
- Anterior inclination of the head of maximum $20–25^\circ$ towards the trunk.
- Arms positioned next to the body, forward oriented maximum $10^\circ$; forearms raised at a maximum $25^\circ$ to the horizontal.
- The angle between thighs and legs $105–110^\circ$ or more.
- Thighs at a maximum $45^\circ$ angle, avoiding a rigid fixation of the hip joint.
- Legs perpendicular to the floor or slightly posterior.
- Feet on the floor forward oriented, in the same plane as the calves; when the feet are positioned symmetrically under the operator’s hands, the posture is balanced [1].

In order to adopt and maintain an ideal posture for as long as possible, the work equipment and the arrangement of the working space (the workstation) must be adapted to the needs of the doctor and “fit like a glove”. Of all the elements of the workstation, the doctor relates most intimately to the chair [1]. The use of an ergonomic chair and its correct adjustment contribute greatly to the adoption and maintenance of a balanced posture. The characteristics of the chair should encourage a good posture.

At least a few things should be considered:

- The adjustment of the chair height is necessary for the correct orientation of the thighs related to the floor and for an angle of minimum $105–110^\circ$ between them and the calves;
- The orientation of the chair base is important for reducing lumbar tension;
- The support of the back of the chair is necessary in order to avoid fatigue of the muscles and to reduce the lumbar curvature during long therapeutic acts;

For long-lasting therapeutic acts, it is important to support the arms at elbow level on the special handles of the chair; this support is implicitly favorable to the shoulders and must be provided bilaterally to respect the symmetry of the body [1].
Personal working experience has helped us to identify the elements that contribute to maintaining a balanced posture, and to outline the major objectives to be pursued, namely, ensuring an optimal working distance and observance of postural symmetry.

**Optimal Working Distance**

Working distance (WD) is the distance measured from the eye lens to the object being viewed or, in other words, from the doctor’s eye plane to the area to be viewed, that is, the working field (teeth and other intraoral tissues) [7]. For a dentist sitting on the ergonomic chair, the working distance is the result of postural variables (doctor’s chair height, head position, back contour, forearm positioning) and the vertical positioning of the patient’s head, which derives from adjusting the elements of the dental chair—base, backrest and headrest. Postural variables are easy to control; they require knowledge of the descriptive elements of a balanced posture. However, their maintenance depends on the position of the patient’s head, determined by the adjustment of the patient’s dental chair segments.

An optimal working distance ensures the doctor good visibility by focusing the gaze at the level of the operating field, providing a sufficient vertical working space for handling the instrument and, as much as possible, limiting the risk of contamination from the oral cavity. All this should be achieved in accordance with a balanced posture. According to the data from the literature, the optimal working distance ranges between 30 and 45 cm, varying with the height of the operator and the size of the bodily segments [7]. An easy-to-use benchmark for establishing the optimal working distance is the level of the doctor’s xiphoid appendage, when sitting in a balanced position. This is also the level at which, naturally, any person sitting on a chair in a balanced position would choose to perform a manual activity using both hands, when the eyes are on the object of work held in
the hands. Thus, the optimal working distance is obtained after positioning the doctor in a balanced position by bringing the patient’s head to the level of the xiphoid appendix (Figure 2).

After the doctor has adopted the balanced posture on the ergonomic chair, the optimal working distance is obtained by positioning the patient’s head vertically, a position determined by three variables: dental chair base height, vertical and horizontal backrest orientation and headrest positioning. It must be borne in mind, when adjusting the working distance, that changing the position of the backrest between vertical and horizontal determines a new vertical position of the patient’s head in relation to the doctor and requires a new height adjustment of the base of the dental chair.

In daily practice, the orientation of the backrest of the dental chair has, mainly, two possibilities:

• Vertical or oblique backrest “high”, closer to vertical—position used when the doctor works in the orthostatic posture or for cases for which the horizontal positioning of the patient is not recommended;
• Horizontal or oblique backrest “low”, closer to horizontal—a position that allows a balanced posture and can be used for most clinical situations of healthy patients.

Positioning the patient horizontally or with a slightly oblique backrest, close to the horizontal, is preferable and should be a first choice because it allows obtaining an optimal working distance and postural symmetry, thus implicitly allowing a balanced posture for the operator. What we call the horizontal position does not correspond to a position of the backrest parallel to the floor but assumes that the tip of the patient’s nose and knees are at the same height.

If we consider a possible discomfort of the patient when placed in a horizontal position, it should be noted that, from an ergonomic point of view, the comfort of the doctor and their balanced posture are more important than the comfort of the patient. This assessment is based on the fact that the doctor spends a lot of time at work and there may be a risk of physical overload when the posture is poor; in addition, the doctor’s recovery outside the work schedule is often insufficient, while the patient’s recovery from discomfort is easy and fast. Fortunately, most often, patients are compliant and accept working positions chosen by doctors.
A short working distance may be generated by the patient’s head position being too high (above the doctor’s xiphoid appendix) or, in the case of a correct positioning of the patient’s head at the level of the xiphoid appendix, the doctor’s excessive bending to approach the work field (bending the head and/or rounding the back), usually when they do not properly see the details of the operating field because of myopia. When the patient’s head has been positioned too high, a series of negative consequences appear: raising the doctor’s shoulders, insufficient space for handling the instruments, increased risk of contamination of the doctor and poor focus of the gaze (Figure 3).

Figure 3. Short working distance.

An increased working distance occurs when the patient’s head is positioned too low (below the doctor’s xiphoid appendix), and this will cause the doctor’s head to bend for visibility, and/or rounding of the back (Figure 4). Additionally, the onset of presbyopia, usually after the age of 40, causes the doctor to increase the working distance by lowering the patient’s dental chair for a clearer view. Optical correction will allow for obtaining an optimal working distance.

Figure 4. Increased working distance.
In conclusion, in order to reach an optimal working distance, we can correct the position of the patient’s head, bringing it to the level of the xiphoid appendix, and if the doctor has a visual deficit, it must be corrected. Therefore, it is advisable for dentists to periodically consult an ophthalmologist to check their visual acuity.

When the object looked upon is very small, as it often occurs in dentistry, the operator can be visually challenged, beyond the natural limits of vision, even when they are healthy. In these situations, there is usually a tendency to shorten the working distance to see better by approaching the operating field, with undesirable effects on posture and/or the eyes (increased fatigue). Because of the natural limits of human vision, dentistry currently uses the means of magnifying the image, namely, magnifying glasses and an operating microscope. The correct choice and use of the magnifying glasses and the operating microscope offer, on one hand, an enlarged image desired by doctors, but also, on the other hand, the possibility to maintain a balanced posture [7].

**Observance of Postural Symmetry**

Postural symmetry is an essential and defining characteristic of a balanced posture and the second element that contributes to maintaining a balanced posture through the entire therapeutic act.

In order to preserve postural symmetry as much as possible, it is necessary to position the patient horizontally or obliquely “down” in order for the doctor to have a greater freedom of movement around the patient’s head and thus to have access and visibility at different areas of the oral cavity. In addition to this, two important aspects must be followed:

- The dentist’s body should be placed according to the intraoral segment being worked on;
- The doctor’s gaze should be oriented perpendicular to the working surface or to its mirror image (when using indirect visibility).

The dentist’s body can be placed according to the intraoral segment being worked on by adjusting their position around the patient’s head and by using optimal visibility—direct or indirect—depending on the intraoral surfaces to be viewed.

In order to be able to define the position of the doctor sitting on the chair around the patient’s head, an image of a clock face superimposed on the patient’s figure is used, with 12 o’clock at the vertex and 6 o’clock at the chin (Figure 5). The dentist can position themself between 7 a.m. and 1:30 p.m. by moving the chair, but remaining in a balanced position. The time at which the doctor must position themself is the time at which the working segment is in the median plane of the doctor’s body, thus avoiding lateral bends of the torso, twisting or other deviations from the balanced posture (Figure 6).

The need for the doctor’s gaze to be oriented perpendicular to the working surface or to its image in the mirror is the second objective to be pursued in order to respect postural symmetry. Naturally, when we look at an optimally positioned image, our gaze is oriented perpendicular to it. Otherwise, we will have to reorient our gaze or the image in order to be able to mentally interpret what we see. Similarly, the dentist adjusts their gaze or the position of the head so that their gaze is oriented perpendicular to the surface of the working field. For a dentist working in a balanced position, the relationship between the direction of the gaze and the surface of the working field depends on the position of the patient’s head on the headrest, because this generates the orientation of the different working surfaces. It is not advisable to modify the position of the doctor’s head in order to adjust this relationship because this would affect the balanced posture. Thus, the correct positioning of the patient’s head on the headrest, depending on the working surfaces, becomes a basic condition to respect postural symmetry.
Starting from a “neutral” position of the head on the headrest, in which case the patient looks directly at the ceiling, the doctor may ask the patient to make a series of movements to orient the working surface under their gaze, thus not having to change their balanced posture. The doctor will not be able to work unless their gaze is pointed directly on the working surface, and they will always look for this relationship. The movements that can be performed by the patient’s head are as follows: left or right rotation, flexion or extension of the
head and lateral flexion (lateral tilt) on the left or right (Figures 7–10). In daily practice, a combination of these movements is used, performed to different degrees. They are performed to a greater extent if the access and visibility are more difficult (especially for the distal areas). Rotation of the head is most often necessary, but there are situations that require extension of the head (e.g., working in indirect visibility on the occlusal surfaces to the upper jaw, Figure 11) or a slight flexion; sometimes lateral flexion corrects the orientation of the working field surface to be directly under the doctor’s eye. Finally, the headrest is adjusted to support the patient’s head in the chosen position.

Figure 7. Patient’s head rotation.

Figure 8. Patient’s head lateral flexion.
Figure 9. Patient’s head extension.

Figure 10. Patient’s head flexion.

Figure 11. Indirect visibility and extension of the head.
Due to the fact that not all intraoral working surfaces can be seen directly without severely affecting the posture, the equation of maintaining postural symmetry also includes the type of visibility. The way the doctor chooses to look at the working surfaces defines the visibility, which can be as follows: direct visibility, when the gaze falls directly on the working surface, or indirect visibility, when the doctor uses the dental mirror. There are many situations in which, depending on the morphology of the dental arches and the intraoral anatomy, in order to respect postural symmetry, the doctor is forced to use indirect visibility. Indirect visibility is more difficult, and problematic compared to direct visibility, which is natural and easy. Many doctors often choose to position themselves primarily to the right of the patient and raise the back of the chair to see directly and avoid indirect visibility, but in doing so, they seriously compromise their posture.

Whenever possible, direct visibility is preferred, but maintaining postural symmetry requires indirect visibility for a number of dental surfaces:

- The upper jaw—the occlusal and palatal surfaces of the teeth;
- The lower jaw—the lingual surfaces of the frontal teeth and the occlusal surfaces when the depth of a cavity, of the pulp chamber or of the endodontic space must be visualized.

Maintaining a balanced posture is easier when working in the anterior areas of the oral cavity (frontal teeth) where the teeth and other anatomical structures are easily accessible and exposed, but it becomes more difficult when accessing distal areas of the oral cavity. Working on the dental surfaces of the last molars, for example, is a challenge both in terms of access and visibility and in maintaining a balanced posture. These situations will often require a compromise on posture which should remain only an exception imposed by the particular clinical situation. In most working situations, a balanced posture can be successfully maintained by knowing all of the above.

**Discussion**

The reality of current practice shows us that deviations from a balanced posture are almost inevitable. When dentists know the importance of a balanced posture, they will be aware of the moments of deviation. These deviations from a balanced posture must be small in amplitude, simple and maintained for a short time. Doctors who have experienced both a balanced posture and various unbalanced postures generating discomfort and health risks will be aware of those moments of deviation and will try to correct them as soon as possible. Unfortunately, if deviations from a balanced posture become a rule of practice and not just an exception, the negative effects will install rapidly.

During a therapeutic act that involves accessing and viewing several surfaces with different orientations, it will be necessary to rearrange the segments of the dental chair, and to change the position of the doctor and the patient’s head, and sometimes the type of visibility.

There are other aspects that affect the doctor’s posture and comfort during work that could not be addressed in this article: ergonomic equipment and its types, prolonged static posture and alternating positions as well as compensation for overloading some body segments during work. All these bring a variable contribution in maintaining doctors’ posture and, implicitly, their health.

**Conclusions**

While trying to logically and systematically present how a balanced posture can be maintained, we hope that this article provides valuable guidelines for safe activities and for the health of dentists. In the first years of
practice, dentists pay less attention to posture, and the overload of some body segments is easy to compensate. After several years of practice, significant problems will arise due to unbalanced positions that will affect the quality of life of doctors and will even lead to limitations of activity. In addition, we believe that it is totally counterproductive for the dentist to sacrifice personal comfort during the therapeutic act because this sacrifice ends up affecting not only their health but also the quality of their work. When a doctor suffers, they will naturally tend to shorten the length of the therapeutic act, and, in addition, the mental concentration necessary for a quality practical execution will no longer be at an optimal level. We consider all these aspects compelling reasons to pay attention to issues related to balanced posture maintenance.

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