

Research Article

Measuring the Effects of a Posture Shirt on Ergonomic Positioning at the Dental Chair

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Abstract

There are numerous studies verifying the correlation between poor posture and musculoskeletal disorders in dentistry (MSDs). The purpose of this study was to determine the short-term effects of wearing an elastomeric garment (Posture Shirt®; AlignMed, USA) and clinician posture. The scope is specific to the back, shoulders, head and neck. Methods and Materials: six subjects were videotaped performing an identical restorative procedure wearing a fitted tee shirt and subsequently one week later in a posture shirt after wearing the posture shirt during the previous week. Their posture wear time during the week was logged. The video data initially and after wearing the posture shirt was analyzed with portions of Branson's Posture Assessment Instrument (BPAI). Results: Benefits were not significant when evaluating all planes of movement (transverse, frontal and sagittal). One of the six subjects improved from harmful to acceptable (16.6%). In the sagittal plane only, four of the six subjects improved from compromised to acceptable (66.6%). Conclusion: It is hoped this research will inform the dental practitioner of an option that may improve their back to front posture for trunk, shoulders, head and neck when performing dental treatment.

Keywords: Ergonomics; BPAI; Dentistry; MSD**Introduction**

There have been few studies on the effects of posture shirt wear with positive ergonomics and musculoskeletal pain relief. The Influence of a Dynamic Elastic Garment on Musculoskeletal and Respiratory Wellness in Computer Use by Decker, Gomas, Narvy and Vangsness [1] is the only published literature that touches on the subject. There have been no studies on posture shirt effectiveness in the dental field to date.

The most prevalent regions for pain in dentists have been shown to be the back (36.3– 60.1%) and neck (19.8–85%) [2,3]. Several studies have indicated that back, neck as well as shoulder pain as major problems among dentists. Finsen et al. (1997) [4] reported 65%; and Chowanadisai et al. (2000) [5] reported 78%.

Musculoskeletal disorders (MSDs) are a major cause of early retirement among dentists [6].

*Musculoskeletal disorders (29.5%)

*Cardiovascular disease (21.2%)

*Neurotic symptoms (16.5%)

*Tumors (7.6%)

*Diseases of the nervous system (6.1%).

Dentistry requires strong endurance of the shoulder girdle stabilizing muscles for strength and range of arm motion. The middle and lower trapezius muscles supply the majority of this support. However, they tend to fatigue quickly when the clinician works with their head in a forward position and have a rounded upper back.

When these muscles tire, the upper trapezius, scapula and upper rhomboids must then compensate and become overworked and tight, resulting in a decreased blood supply and oxygenation to these tissues (Figure 1).

“Continual work in front of and below the operator’s eye level leads to a forward head and rounded shoulder posture. This can cause weakening and elongation of the stabilizer muscles of the shoulder blades (middle and lower trapezius, rhomboid and serratus anterior muscles). As a result, the shoulder blades tend to move away from the spine, leading to rounded shoulder posture. Meanwhile, anterior “mover” muscles (scalene, sternocleidomastoid and pectoralis) become short and tight, pulling the head forward” [7].

Posture affects the ability of the dental clinician to reach, hold, and use equipment. It also influences how long the task can be performed without suffering adverse health effects. Over 3 time, any position will eventually become fatiguing and may lead to MSDs. An MSD is characterized by presence of discomfort, disability or persistent pain in the joints, muscles, tendons, and other soft parts, caused or aggravated by repeated movements and prolonged awkward or forced body postures [7]. It is also important to note that the weight of the head greatly increases as it tilts forward, placing increased neck stress on C1-C7 [8] (Table 1).

For dentists to perform effectively, they need to have a posture position that allows them to achieve optimum access, visibility, comfort, and control at all times [9].

Research Hypothesis

To determine the short-term effects of wearing the Posture

Table 1:

Position	Neutral	15°	30°	45°	60°	90°
Force To Cervical Spine	10-12lbs.	27lbs.	40lbs.	49lbs.	60lbs.	Not Measurable

The weight seen by the spine increases when flexing the neck at varying degrees. An adult head weighs 10-12 pounds in the neutral position. As the head tilts forward the forces seen by the neck surges to 27 pounds at 15 degrees, 40 pounds at 30 degrees, 49 pounds at 45 degrees and 60 pounds at 60 degrees.

AREA	CRITERIA		
Trunk (Front to back to back angulation)	A: <20 degrees degrees 1 Point	C: >20-<45 degrees 3 Points	H: >45 2 Points
	A: <20 degrees degrees 1 Point	C: >20-<45 degrees 3 Points	H: >45 2 Points
Trunk (Side to side angulation)	A: <20 degrees degrees 1 Point	C: >20-<45 degrees 3 Points	H: >45 2 Points
	A: <20 degrees degrees 1 Point	C: >20-<45 degrees 3 Points	H: >45 2 Points
Trunk (Rotation between planes)	A: <20 degrees degrees 1 Point	C: >20-<45 degrees 3 Points	H: >45 2 Points
	A: <20 degrees degrees 1 Point	C: >20-<45 degrees 3 Points	H: >45 2 Points
Shoulder Assessment	A: Relaxed 1 Point	C: Slumped Forward 2 Points	H: >45 2 Points
	A: Level with trunk 1 Point	C: One or both elevated above line of trunk 2 Points	H: >45 2 Points

A: ACCEPTABLE C: COMPROMISED H: HARMFUL

Table 2: Modified Branson's Posture Assessment Instrument.



Figure 2: Tee Shirt – Back.

Figure 1-20
Superficial and deep muscles that act at the scapulothoracic articulation

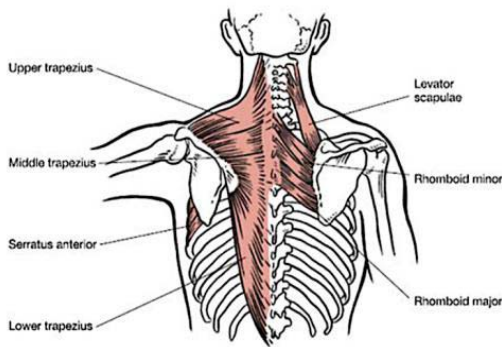


Figure 1: American Council on Exercise, May 2017.



Figure 3: Posture Shirt – Back.

Shirt® with subjective assessments of posture, including head, neck, shoulder and back. It is a garment with an anatomic matrix of bands, panels and seams, collectively referred to as NeuroBands®. The company describes the shirt as wearable therapy to retrain muscles and improve muscle tone, performance, posture, poise and reduce pain.

Methods and Materials

Participants: The pool of participants for the feasibility study consisted of three third and three fourth year predoctoral dental students at the UMKC School of Dentistry. Exclusion criteria for subjects included those with congenital musculoskeletal disorder, rheumatoid arthritis, past history of MS surgeries and current pregnancy. The protocol for the study was approved by an institutional review board (IRB 16-327).

VISIT 1: A dental school simulation laboratory work station was utilized for the study. The subjects were given a size appropriate white tee shirt. They adjusted the operator’s stool and typodont head to a comfortable working position. Colored Velcro dots were used to mark the right tragus of the ear. On the tee shirt, the dots were placed at the apex of the right and left deltoid muscles, spine of the scapula adjacent to the deltoids, C7, T6, T12 and L3 vertebrae.

Velcro dots marked the Dr.’s stool horizontally (Figure 2,4). The

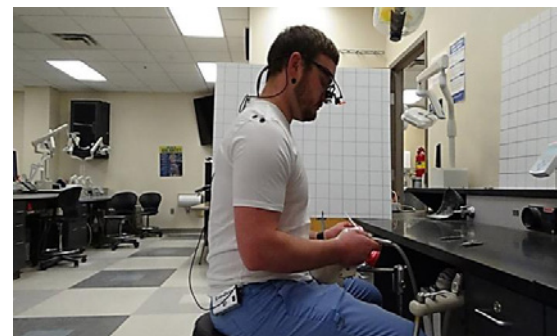


Figure 4: Tee Shirt – Back.

subjects then performed a mesiolingual CI II composite operative preparation procedure on the maxillary right central incisor on a typodont head affixed to a stand. Subjects who normally wore loupes in the clinic were asked to wear them. Subjects were videotaped and photographed from the back and side over a five minute time period from the commencement of the tooth preparation. Posture measurements still photos were captured at intervals of 0, 1, 3 and 5 minutes during the 5-minute recording span.

The neck, trunk and shoulders were measured at variance from neutral posture. Vectorworks® was utilized for angulation

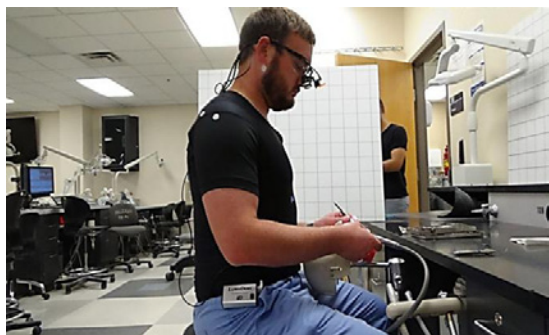


Figure 5: Posture Shirt – Side.



Figure 6: Posture Shirt –Side with angulation measurements.

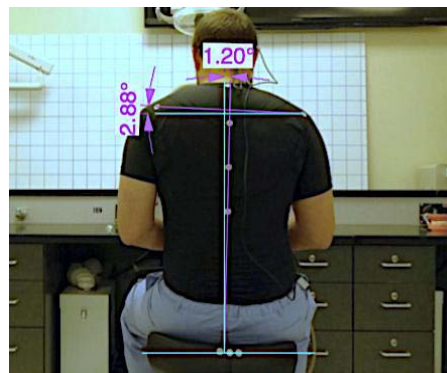


Figure 7: Posture Shirt - Back with angulation measurements.

Table 3:

TOTAL POINTS BPAI :	ACCEPTABLE: <18, TEE SHIRT (TS)	COMPROMISED : 19-30, POSTURE SHIRT (PS)	HARMFUL 31-48 REDUCTION IN
1300	25 (C)	21 (C)	16.00%
1301	31 (H)	18 (A)	42.00%
1302	33 (H)	21 (C)	36.40%
1303	24 (C)	21 (C)	12.50%
1304	24 (C)	21 (C)	12.50%
1305	29 (C)	20 (C)	31.00%

Results

Utilizing the modified BPAI for the Trunk, Shoulders and Head/Neck in the Sagittal, Frontal and Transverse Planes for the 6 subjects, one subject improved from Harmful to Acceptable (16.6%), one from Harmful to Compromised and the other four remained Compromised, with decreases in BPAI numerical score. The average percent improvement, regardless of BPAI criteria score was 25.07 % (Table 3).

Since the Posture Shirt® did not appear to significantly improve the BPAI criteria for Trunk Side to Side, Rotation Between Planes and Shoulders Level with Trunk, a second analysis was performed utilizing only the Sagittal Plane for movement: Trunk (Front to Back), Head/Neck (Front to Back) and Shoulders (Relaxed or Slumped Forward). Four of the 6 subjects (66.6%) improved from Compromised to Acceptable. The average percent improvement, regardless of BPAI criteria score was 23.0 % (Table 4).

The six subject’s average wear of the Posture Shirt® was 5.66 days totaling 42.46 hours with 6.07 hours of wear per day.

Conclusion

With heavily booked schedules, complex dental procedures and patient management issues, it is easy to overlook proper clinician positioning. It would appear that wearing the Posture Shirt® shows promise in improving a dentist’s posture for trunk, shoulders, head and neck in the sagittal plane when performing dental restorative procedures. This elastomeric garment shows potential in having positive results for operator’s posture, comfort and career longevity. It is a passive method to activate, reprogram and provide a more

measurements derived from the video and still photography captured during each session.

The subjects then changed into their size appropriate Posture Shirts®. Colored Velcro dots were then used to mark the right tragus of the ear. On the posture shirt, the dots were placed at the apex of the right and left deltoid muscles, spine of the scapula adjacent to the deltoids, C7, T6, T12 and L3 vertebrae (Figure 3,5). The subjects were instructed to wear the posture shirt® daily during dental school-related activities for the next seven days.

They were dispensed a wear log and asked to record the hours and days the shirt was worn and to bring the log with them to their next scheduled visit. They were asked to wear the shirts a minimum of 6 hours per day for 4 days.

VISIT 2: The subjects returned wearing their pre-marked Posture Shirt®. They then performed the same procedure as Visit 1 - a mesio-lingual CI II composite operative preparation procedure on the maxillary right central incisor on a typodont head affixed to a stand. Subjects were videotaped from the back and side over a five-minute time period from the commencement of the tooth preparation. Still photos were captured at 0, 1, 3 and 5 minutes.

Once the angulation measurements were derived (Figure 6,7), a modified Branson’s Posture Assessment Instrument (BPAI) [10] was utilized to calculate the point totals for the head/neck, shoulders and trunk for each subject (Table 2). The hips, head/neck side to side as well as rotation between planes and wrist were omitted due to lack of relevance to areas of the elastomeric shirt that are measurable.

Table 4:

TOTAL POINTS BPAI :	ACCEPTABLE: <=9	COMPROMISED : 10-18,	HARMFUL 19-30
SUBJECT REDUCTION IN SCORE	TEE SHIRT (TS)	POSTURE	SHIRT (PS)
1300	14 (C)	12 (C)	14.30%
1301	17 (C)	9 (A)	47.10%
1302	18 (C)	12 (C)	33.40%
1303	11 (C)	9 (A)	18.20%
1304	12 (C)	9 (A)	25.00%
1305	13 (C)	9 (A)	30.80%

neutral muscular posture. This can lead to improved quality for patient treatment, a healthier way to practice and potentially lessen future musculoskeletal issues. A pilot study with a larger subject pool over a greater length of time is recommended to further substantiate findings.

Acknowledgement

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