The Relationship Between Forward Head Posture and Temporomandibular Disorders

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This study investigated the relationship between forward head posture and temporomandibular disorder symptoms. Thirty-three temporomandibular disorder patients with predominant complaints of masticatory muscle pain were compared with an age- and gender-matched control group. Head position was measured from photographs taken with a plumb line drawn from the ceiling to the lateral malleolus of the ankle and with a horizontal plane that was perpendicular to the plumb line and that passed through the spinous process of the seventh cervical vertebra. The distances from the plumb line to the ear, to the seventh vertebra, and to the shoulder were measured. Two angles were also measured: (1) ear–seventh cervical vertebra–horizontal plane and (2) eye–ear–seventh cervical vertebra. The only measurement that revealed a statistically significant difference was angle ear–seventh cervical vertebra–horizontal plane. This angle was smaller in the patients with temporomandibular disorders than in the control subjects. In other words, when evaluating the ear position with respect to the seventh cervical vertebra, the head was positioned more forward in the group with temporomandibular disorders than in the control group ($P < .05$).

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In recent years, the dental profession has become increasingly aware of the postural relationships between the head and neck. Many authors have suggested that posture relates to the status of health,[1–27] and that poor posture can lead to pain and dysfunction.[4–6,28–45] Several authors[5,33–43] have suggested that a forward head posture is closely associated with certain temporomandibular disorder (TMD) symptoms. With this assumption, some clinicians[39–43] have suggested that correction of the forward head posture is indicated for the reduction of TMD symptoms. Unfortunately, the literature does not contain many scientific studies that investigate the relationship between forward head posture and TMD symptoms. In one study, Huggare and Raustia[33] found a relationship between forward head posture and TMD symptoms. In studies by Darlow et al[46] and Hackney et al,[47] no such relationship was found. It appears that a relationship between forward head posture and TMD symptoms has not yet been clearly established.

The purpose of this study was to determine if a group of patients with TMD symptoms presented with a greater incidence of forward head posture than did a sex- and age-matched control group.

Fig 1 Subject positioned between the two lateral plumb lines. The dot on her shoulder marks the acromial joint of the shoulder, and the point marked on her neck marks the spinous process of the seventh cervical vertebra.

Materials and Methods

Participants in this study were selected from a group of patients who were referred to University of Kentucky Orofacial Pain Center with TMD symptoms. In order to be included, each subject had to meet the following criteria:

1. The subject's chief complaint was related to pain in the muscles of mastication.
2. Jaw movement and function increased the painful condition.
3. The masticatory muscles (masseter and temporalis) were tender to digital palpation.
4. The maximum comfortable interincisal opening was less than 40 mm.
5. Temporomandibular joint (TMJ) pain may or may not have been present.
6. Cervical muscle pain may or may not have been present.

These criteria were developed to assure that masticatory muscle pain was present. It was hypothesized that posture would likely have its greatest affect on muscle function, and therefore, the patient group should include masticatory muscle pain problems. Patients with masticatory muscle pain who also had pain related to the TMJ or the cervical muscle were included. Patients who had TMJ pain or cervical muscle pain but no masticatory muscle pain were excluded.

The patient group comprised 30 females and three males with an average age of 31.4 years (± 10.1) and a range of 13 to 65 years. Thirty-three sex- and age-matched subjects were selected as controls from a university student and staff population who met the following sex and age criteria:

1. Each control subject reported no present or past history of head or neck pain.
2. Digital palpation of the masseter and temporalis muscles revealed no tenderness or pain.
3. Comfortable mouth opening was greater than 40 mm.
4. The age of each control subject was within ± 1 year of the matched subject.

Each subject was asked to stand on a designated spot on the floor. Three plumb lines were hung from the ceiling. One plumb line with a millimeter ruler was positioned in front of the subject's face, and the other two plumb lines were positioned to the right and left of the subject's shoulders. The subject's feet were positioned so that the lateral plumb lines were 1 cm in front of the posterior edge of the lateral malleolus of the ankles. The subject was asked to stand in a comfortable position with the head held in its natural balance and the arms relaxed to the side. These instructions were similar to the method described by Woodhull et al.[48] Each subject was instructed to focus on the horizon through a window in front of which he or she was standing. None of the subjects was informed that the study involved posture.

By manual palpation, the seventh cervical vertebra (C7) was located and marked with tape. The acromial joint of the left shoulder was also located as the most predominantly bony area of the superior region of the shoulder. A 105-mm macro Nikon camera was placed on a tripod and positioned laterally 2 m from the subject's left side.

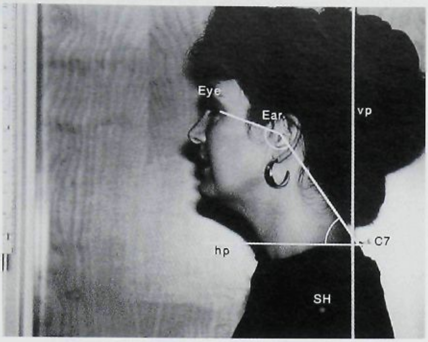

Fig 2 Subject from Fig 1 with the reference lines marked. Eye = lateral corner of the eye; Ear = most superior portion of the external auditory meatus; vp = vertical plumb line; C7 = spinous process of the seventh cervical vertebra; hp = horizontal plane through C7, perpendicular to vp; SH = acromial joint of the shoulder.

The two lateral plumb lines were aligned to superimpose each other. The camera was raised until it was at the level of the mandibular angle of the subject. A color slide was then taken of each subject (Fig 1).

The slide was developed and projected on grid paper where measurements were taken. The distances were measured by using the millimeter ruler in the photograph that had been positioned on the anterior plumb line. The following locations were identified on the grid paper:

1. Spinous process of C7
2. Most superior portion of the external auditory meatus
3. Acromial joint of the shoulder
4. Lateral corner of the eye

A line perpendicular to the lateral plumb line was drawn to each of these locations, and the distance in millimeters was measured from the plumb line to the landmark.

A horizontal plane reference (hp) was drawn through C7 perpendicular to the plumb line (Fig 2). A line was drawn from C7 to the most superior portion of the external auditory meatus (Ear), and another line was drawn from Ear to the corner of the eye (Eye). The angle between hp and line C7–Ear was measured in degrees. The angle between C7–Ear and Ear–Eye was also measured in degrees (Fig 2).

Results

Table 1 lists all raw data collected from the control subjects. Table 2 lists all data from the subjects with TMD symptoms. The mean values and standard deviations for the five measurements are summarized in Table 3. A paired t test was used to determine whether any statistically significant differences existed between the TMD subjects and the control subjects in any of the investigated measurements. The only one of five measurements that revealed a statistically significant difference was that of angle Ear–C7–hp. This angle (Ear–C7–hp) was smaller in the TMD patients than in the control subjects. In other words, when evaluating the ear position with regard to C7, the head was positioned more forward in the TMD group than in the control group ($P < .05$).

Discussion

Several weaknesses must be acknowledged in this study. The patients with TMD were not subdivided into specific diagnostic subcategories such as those having only masticatory muscle pain or those having only intracapsular pain disorders. Since this study did not evaluate specific subcategories, the conclusions can only be generalized to the large group of patients having masticatory muscle pain with and without TMJ pain or cervical pain. Another weakness of this study, as well as any postural study, is that subjects may have altered their normal head posture for the photo-

Table 1 Lengths and Angles Used For Determining Head Posture of Control Subjects

			Lengths			Angles	
No.	Age	Gender	Ear-vp (mm)	C7-vp (mm)	SH-vp (mm)	Eye-Ear-C7 (degrees)	Ear-C7-hp (degrees)
1	64	F	4.9	2.9	1.4	148	53
2	51	F	3.9	0.8	3.6	126	68
3	43	F	3.8	1.5	4.3	136	63
4	42	F	5.2	5.0	0.6	147	48
5	43	F	6.1	4.4	1.9	135	51
6	41	M	9.8	–0.6	1.7	145	50
7	37	F	3.6	3.6	1.6	149	55
8	37	F	5.0	2.7	3.5	143	53
9	36	F	10.1	–1.4	7.6	149	52
10	36	F	7.3	0.8	5.7	144	50
11	35	M	9.8	–0.6	1.7	145	50
12	35	F	9.4	–2.0	4.8	134	58
13	34	M	3.5	5.4	0.6	151	51
14	31	F	4.5	5.5	5.7	140	53
15	31	F	2.5	3.3	1.0	135	60
16	31	F	4.7	2.5	–0.6	135	56
17	30	F	4.6	4.0	2.9	152	55
18	29	F	2.8	2.4	3.6	140	61
19	27	F	7.5	1.6	4.2	146	48
20	27	F	5.2	2.8	2.6	149	52
21	26	F	4.9	1.3	2.4	141	57
22	25	F	8.0	0.4	7.8	152	52
23	24	F	6.9	1.7	7.2	140	58
24	24	F	3.9	2.9	1.0	135	50
25	24	F	5.1	2.4	1.0	145	52
26	24	F	8.8	0.0	5.6	142	49
27	24	F	7.6	–0.4	4.7	142	56
28	23	F	11.4	–4.2	9.6	137	60
29	23	F	8.2	–0.6	3.9	144	54
30	19	F	5.6	0.4	6.0	140	53
31	17	F	5.2	2.3	3.2	148	55
32	16	F	6.2	1.9	3.5	145	51
33	13	F	7.6	–0.6	4.1	142	52

Ear = most superior portion of the external auditory meatus
vp = vertical plumb line
C7 = spinous process of the seventh cervical vertebra
SH = acromial joint of the shoulder
Eye = lateral corner of the eye
hp = horizontal plane through C7, perpendicular to vp

graph. In order to minimize any postural correction, subjects were not informed prior to the photograph that this study involved posture.

The results of this study revealed no statistically significant difference between forward head posture in a group with TMD and that in a sex- and age-matched control group in regard to four of five measurements. There was, however, a statistically significant difference in angle Ear–C7–hp. Therefore, the results of this study are mixed. The four measurements that revealed no statistically significant difference are in agreement with the findings of Darlow et al[46] and Hackney et al,[47] but not in agreement with the findings of Huggare and Raustia.[33] The only measurement that did reveal a statistically significant difference is in agreement with the findings of Huggare and Raustia,[33] but not in agreement with the findings of Darlow et al[46] and Hackney et al.[47]

It appears that the relationship between forward head posture and TMD is not a simple one. Additional well-controlled studies are needed to identify the exact relationship, if any, between forward head posture and TMD symptoms.

Table 2 Lengths and Angles Used For Determining Head Posture of Subjects With TMD

			Lengths			Angles	
No.	Age	Gender	Ear-vp (mm)	C7-vp (mm)	SH-vp (mm)	Eye-Ear-C7 (degrees)	Ear-C7-hp (degrees)
1	65	F	3.9	2.3	1.9	140	54
2	50	F	5.2	1.9	3.1	152	52
3	42	F	5.5	3.5	1.6	145	48
4	40	F	7.3	1.0	0.2	144	49
5	39	F	4.2	4.2	1.6	141	57
6	39	M	7.2	0.4	8.3	141	60
7	36	F	9.6	–0.7	5.2	147	53
8	36	F	7.2	1.5	4.6	147	53
9	35	F	10.0	–2.9	7.4	141	55
10	35	M	18.2	–7.6	14.8	146	49
11	35	F	4.7	3.4	3.2	134	58
12	34	M	10.1	0.4	5.0	147	38
13	34	F	5.0	3.0	1.6	138	52
14	34	F	8.8	0.0	4.8	151	53
15	34	F	4.9	4.2	0.8	146	50
16	33	F	6.7	0.4	6.3	142	58
17	32	F	6.0	1.1	1.2	137	58
18	31	F	8.6	–1.4	2.7	147	53
19	30	F	7.3	1.3	4.4	144	48
20	29	F	5.2	1.9	3.8	136	61
21	28	F	4.0	3.4	2.7	136	52
22	27	F	4.5	3.1	3.5	144	49
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24	26	F	7.8	–3.2	3.4	144	45
25	24	F	7.0	0.9	4.1	139	50
26	24	F	7.0	0.6	5.5	138	55
27	24	F	13.7	–3.9	8.9	138	40
28	23	F	6.3	0.2	5.2	142	55
29	20	F	5.9	3.8	3.6	156	45
30	18	F	11.0	–1.4	4.7	142	47
31	16	F	6.0	2.3	2.9	128	57
32	15	F	9.4	0.3	3.4	141	43
33	13	F	7.8	1.5	3.3	143	48

Ear = most superior portion of the external auditory meatus
vp=vertical plumb line
C7 = spinous process of the seventh cervical vertebra
SH = acromial joint of the shoulder
Eye = lateral corner of the eye
hp = horizontal plane through C7, perpendicular to vp

Table 3 Mean Values and Standard Deviations of Measurements for Control Group and the Group with the TMD

Measurement	Control	TMD
Ear-vp (mm)	6.2 ± 2.3	7.4 ± 3.0
C7-vp (mm)	1.6 ± 2.2	0.8 ± 2.5
SH-vp (mm)	3.6 ± 2.4	4.2 ± 2.8
Eye-Ear-C7 (degrees)	142.5 ± 6.1	142.5 ± 5.5
Ear-C7-hp (degrees)	54.1 ± 4.5	51.4 ± 5.5*

*$P < .05$
Ear = most superior portion of the external auditory meatus
vp = vertical plumb line
C7 = spinous process of the seventh cervical vertebra
SH = acromial joint of the shoulder
Eye = lateral corner of the eye
hp = horizontal plane through C7, perpendicular to vp

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Resumen

La Relación entre la Postura Anterior de la Cabeza y los desórdenes Temporomandibulares

Este estudio investigó la relación entre la posición anterior de la cabeza y los síntomas de desórdenes temporomandibulares (DTM). Se compararon 33 pacientes que sufrían de DTM con problemas predominantos de dolor muscular masticatorio (grupo experimental), con un grupo de control cuyas edades y géneros eran iguales a las del grupo experimental. Se midió la posición de la cabeza en las fotografías tomadas con una plomada que caía desde el techo hasta el maléolo lateral del tobillo, y con un plano horizontal que estaba perpendicular a la plomada y que pasaba a través del proceso espinoso de la séptima vértebra cervical. Se midieron las distancias de la plomada al oído, a la séptima vértebra, y al hombro. También se midieron dos ángulos formados por: *(1)* la oreja-séptima vértebra cervical-plano horizontal y *(2)* el ojo-oreja-séptima vértebra cervical. La única medida que indicó la existencia de una diferencia estadísticamente significativa, fue la del ángulo fue mas pequeño en los pacientes con DTM en comparación al grupo de control. En otras palabras, cuando se evaluó la posición de la oreja con respecto a la séptima vértebra cervical, la cabeza se posicionó mas anteriormente en el grupo que sufría de DTM en comparación al grupo de control ($P < 0,05$).

Zusammenfassung

Die Beziehung zwischen Vorhaltestellung des Kopfes und Myoarthropathien des Kausytems (MAP)

Diese Studie untersuchte den Zusammenhang zwischen der Vorhaltestellung des Kopfes und Symptomen der Myoarthorpathie des Kausystemes (MAP). 33 Patienten mit MAP, mit Schmerzen hauptsächlich in der Kaumuskulatur, wurden mit einer Kontrollgruppe gleicher Alters- und Geschlechtsverteilung verglichen. Die Kopfposition wurde auf Photos gemessen, die mit einer senkrechten Linie won der Decke zum Malleolus des Knöchels und einer dazu rechtwinklig verlaufenden Horizontalen durch den processus spinosus des siebten Halswirbels aufgenommen worden waren. Der Abstand zwischen der Senkrechten und dem Ohr, dem processus spinosus und der Schulter wurde gemessen. Des weitern wurden 2 Winkel gemessen: *1.* Ohr-siebter Halswirbel-Horizontale, *2.* Auge-Ohr-siebter Halswirbel. Der einzige Wert, der statistisch signifikante Unterschiede aufzuweisen vermochte, war der Winkel Ohr-siebter Halswirbel-Horizontale. Dieser Winkel war bein MAP-Patienten kleiner als in der Kontrollgruppe. Mit andern Worten, wenn die Position des Ohrs relativ zum siebten Halswinkel verglichen wurde, trugen die MAP-Patienten ihren Kopf mehr nach vorne gehalten als die Probanden der Kontrollgruppe ($P < 0,05$).