ความสัมพันธ์ของสันกระพุ้งแก้มเหตุสบฟัน และปัจจัยที่เกี่ยวข้องกับโรคในกลุ่มข้อต่อขากรรไกร และกล้ามเนื้อบดเคี้ยว: การสำรวจเบื้องต้น ในคณะทันแพทยศาสตร์ ของไทย 4 สถาบัน ในช่วงเวลาหนึ่ง

THE CORRELATION BETWEEN BUCCAL MUCOSA RIDGING AND TMD PREDISPOSING FACTORS: A PRELIMINARY CROSS SECTIONAL SURVEY IN THAI 4 DENTAL SCHOOLS

สรสัณห์ รังสิยานนท์[1], เพ็ญศรี โพธิภักดี[2], พรพรรณ พิบูลย์รัตนกิจ[3], ภัทรายุ แต่บรรพกุล[4], ขจรเดช วนรัตน์[5]

***Sorasun Rungsiyanont[1],** Pensri Photipakde[2], Pornpan Piboonratanakij[3], Patrayu Taebunpakul[4], Kajorndej Wanaratana[5]*

[1]ภาควิชาศัลยศาสตร์และเวชศาสตร์ช่องปาก คณะทันตแพทยศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ

[1]Department of Oral Surgery and Oral Medicine, Faculty of Dentistry, Srinakharinwirot University.

[2]ภาควิชาเวชศาสตร์ช่องปาก คณะทันตแพทยศาสตร์ มหาวิทยาลัยขอนแก่น

[2]Department of Oral Medicine, Faculty of Dentistry, Khonkaen University.

[3]ภาควิชาเวชศาสตร์ช่องปาก คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

[3]Department of Oral Medicine, Faculty of Dentistry, Chulalongkorn University.

[4]ภาควิชาศัลยศาสตร์และเวชศาสตร์ช่องปาก คณะทันตแพทยศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ

[4]Department of Oral Surgery and Oral Medicine, Faculty of Dentistry, Srinakharinwirot University.

[5]คณะทันตแพทยศาสตร์ มหาวิทยาลัยธรรมศาสตร์

[5]Faculty of Dentistry, Thammasat University.

บทคัดย่อ

ระบบข้อต่อขากรรไกรและกล้ามเนื้อบดเคี้ยวผิดปกติเป็นปัญหาทางคลินิกที่พบได้บ่อยและส่งผลต่อคุณภาพชีวิตของผู้ป่วย ปัจจุบันการวินิจฉัยโรคในกลุ่มความผิดปกตินี้อาศัยเพียงประสบการณ์ของผู้ตรวจ ยังไม่มีตัวชี้วัดทางคลินิกที่ดีจะช่วยในการวินิจฉัยผู้ป่วยที่ยังไม่มีอาการทางคลินิก มีรายงานที่น่าสนใจบ่งบอกความสัมพันธ์ระหว่างสันกระพุ้งแก้มเหตุสบฟันกับพฤติกรรมบางอย่างที่เป็นปัจจัยเสี่ยงต่อการเกิดความผิดปกตินี้ วัตถุประสงค์ของงานวิจัยครั้งนี้ เป็นการศึกษาถึงความสัมพันธ์ของสันกระพุ้งแก้มเหตุสบฟันกับปัจจัยเสี่ยงที่ก่อให้เกิดความผิดปกติของระบบข้อต่อขากรรไกรและกล้ามเนื้อบดเคี้ยวจากข้อมูลผู้ป่วย 1,000 คน โดยกำหนดผู้ป่วย 500 คนมีสันกระพุ้งแก้มเหตุสบฟันเป็นกลุ่มทดลองและผู้ป่วยอีก 500 คนที่ไม่มีสันกระพุ้งแก้มเหตุสบฟันเป็นกลุ่มควบคุม โดยผู้ป่วยทั้งหมดเป็นผู้ป่วยนอกที่เข้ารับการตรวจและรักษา

ที่คณะทันตแพทยศาสตร์ 4 สถาบัน สถาบันละ 250 คน (กลุ่มควบคุมและกลุ่มทดลองกลุ่มละ 125 คน เท่าๆ กัน) ผู้ตรวจทุกคนได้ปรับมาตรฐานการตรวจ จำแนกข้อมูลตามอายุ เพศ การมีหรือไม่มีสันกระพุ้งแก้มเหตุสบฟัน ปัญหาของระบบข้อต่อขากรรไกรและกล้ามเนื้อบดเคี้ยว รูปแบบการอ้าปากที่ผิดปกติ การสูญเสียฟันหลังและการใส่ฟันปลอม ทดสอบข้อมูลด้วยตัวแปรทางสถิติ ออดเรโชโลจิสติกรีเกรสชั่นและเพียสันไคว์แสคร์ที่ระดับความเชื่อมั่น 95% ผลการศึกษาพบความสัมพันธ์ระหว่างสันกระพุ่งแก้มเหตุสบฟันกับรูปแบบการอ้าปากที่ผิดปกติและการใส่ฟันปลอมบางส่วนชนิดถอดได้อย่างมีนัยสำคัญทางสถิติ ($p<0.05$)

คำสำคัญ: สันกระพุ้งแก้มเหตุสบฟัน ความผิดปกติของระบบข้อต่อขากรรไกรและกล้ามเนื้อบดเคี้ยว รูปแบบการอ้าปากที่ผิดปกติ การสูญเสียฟันหลัง ฟันปลอม

Abstract

Temporomandibular disorder (TMD) is the clinical problem that frequently found and affect quality of life. Nowaday, diagnosis is depended on the experiences of the examiners. There is no good clinical indicator to help diagnosing TMD in asymptomatic cases. Many studies reported the association between buccal mucosa ridging and parafunctional habits that were accepted as predisposing factors for TMD. The purpose of this study is to clarify the association between buccal mucosa ridging and TMD predisposing factors. One thousand data (500 who has buccal mucosa ridging and 500 who has no buccal mucosa ridging) was collected from out patients of 4 Thai dental schools by calibrated investigators, 250 from each school equally (125 for control and 125 for experiment group). The data collection were age, sex, presence or absence of buccal mucosa ridging, TMD, jaw opening patterns, masticatory muscle symptoms, loss of posterior teeth and denture wearing. All data were statistically analysed by odd ratio, logistic regression and chi-square test at significant level of $p=0.05$. The result showed that there is relationship between buccal mucosa ridging and abnormal jaw opening patterns and removable partial denture wearing ($p<0.05$).

Keywords: Buccal mucosa ridging, TMD, Jaw opening patterns, Loss of posterior teeth, Denture

Introduction

Temporomandibular disorder (TMD) is a clinical problem causing chronic orofacial pain and suffering among people aged 25-40. The clinical diagnosis of TMD is not yet exactly defined. This is due to both the lack of specific criteria to be used for TMD diagnosis and no research Diagnosis Criteria (RCD). In addition, the symptoms of the patient are usually not confined to one area. Moreover, TMD can be caused by both problems of the joint itself and the masticatory muscles, complicating the diagnosis. Previous studies have shown multiple factors affect the development of TMD including individual stress levels, profession, sex, and age. However, the specific pathogenesis of TMD remains unidentified. Because misdiagnosis or false positive diagnosis can lead to an improper

treatment plan for the patient, it is important to establish a good diagnostic indicator for TMD.

Currently, two major methods are widely used to diagnose TMD. A questionnaire focusing on the signs and symptoms of TMD patients is a commonly employed method. One drawback of this method is that some pertinent information may not be elicited due to the patient not understanding some questions. Another method is clinical examination, but this method is not objective and subject to bias. Indeed, both methods are limited by their subjective nature. Previous studies report buccal mucosa ridging and tongue indentation can be an indicator of bruxism, a predisposing factor for TMD [1-2]. Other factors causing buccal mucosa ridging or hypertrophy of the buccal epithelium; tooth clenching, cheek biting, tongue thrusting, and lips sucking, can also be predisposing factors for TMD [3]. The incidence of these habits are related to age and sex and are found in females more than in males of patients ranging between 20-29 years old. Vertical dimension loss is another factor in the development of an intraoral vacuum effect due to the extra force from masseter muscle, buccinator muscles and lateral tongue indentation [3]. Amemori et al. [4] reported abnormal movement of the lower jaw during bruxism could cause injuries to the temporomandibular joint and the muscles of mastication, leading to TMD. They suggested that maloclusion may not be involved in the development of bruxism and tooth clenching [4].

Reports on parafunctional activities indicate clenching or grinding are major causes of TMD [5-6]. These parafunctional habits were reported to delay healing and prolong the duration of the TMD [7]. Pahkala and Laine-Alava [8] stated malocclusion and occlusal interference are prognostic factors for TMD. Moreover, anterior open bite may lead to tenderness at the temporomandibular joint, while large overjet and anterior open bite can lead to clicking sounds in the joint during jaw opening or deviation.

Concerning a correlation between sex and TMD, there are many reports showing females have a higher frequency of TMD than males [8]. These findings corresponded with stress levels, which are higher in females than in males, and the inclination of females to visit the dentist more often than males [9]. Some groups hypothesized the healing and repair process occurs more rapidly in males than in females [8-11]. Epidemiologic studies report TMD can be found in all ages and can have a high prevalence among the elderly [10-11].

Objectives

The aim of the present study is to clarify the correlation between buccal mucosa ridging (linea alba buccalis) and TMD predisposing factors. If the study shows the positive relationship between these factors, buccal mucosa ridging will be used as a diagnostic indicator for TMD. It can help diagnosing TMD more accurate and free from examiners bias.

Methods

The population for this study comprised patients presenting for oral examination and treatment planning from 2006-2007 at four Thai Faculties of Dentistry (Srinakharinwirot University,

Chulalongkorn University, Khonkaen University, and Thammasat University). From this population, 1,000 subjects were selected, 125 subjects presenting with buccal mucosa ridging and 125 control subjects from each school (500 subjects with buccal mucosal ridging and 500 without buccal mucosa ridging as control). All procedures in this study had prior approval from the Ethics Committees of all the participating Universities. The subjects were evaluated for TMD predisposing factors and TMD signs by calibrated examiners (Kappa standard calibration). The TMD predisposing factors evaluated were age, sex, and abnormal oral habits such as bruxism and clenching. The signs of TMD evaluated were joint clicking sounds, locked jaw, or abnormal jaw opening patterns such as jaw deviation or jaw deflection. The history of locked jaw and the muscle of mastication evaluation which classified as muscle tenderness and muscle spasm were recorded. Any missing posterior teeth or wearing of fixed/removable prostheses was recorded. The data were analyzed using Odds ratio, Chi-square test ($p<0.05$), and Logistic regression to identify any relationships between the presence of buccal mucosa ridging and predisposing factors to TMD.

Results

The present study comprised 1,000 subjects (366 males (36.6%) and 634 females (63.4%) ranging in age from 12 to 81 yrs (mean of 34.8 +/- 13.6 yrs.). The majority did not have underlying systemic disease (89.9%) and denied the use of systemic medication (78.8%). TMD signs were present in 31% of the subjects while 69% of the subjects had no signs of TMD. Unilateral clicking (64.2%) was the most common TMD factor found, with bilateral clicking and joint pain found at 30.6% and 5.2%, respectively. Bilateral buccal mucosa ridging was identified in 41.4 % of the study subjects.

Factors affecting TMD (table1) were found in 50% of the subjects missing posterior teeth. Abnormal jaw opening patterns and abnormal oral habits were present in 36.7% and 25.9% of the subjects, respectively. Considering missing posterior teeth, most patients exhibited loss from all 4 quadrants (34%) with loss of teeth in 2 quadrants and 1 quadrant noted in 30.2% and 22.4% of the subjects, respectively.

Among subjects with factors relating to TMD, abnormal jaw opening patterns, including jaw deviation (84.2%), jaw deflection (15.0%), and locked jaw (0.5%), were found. Abnormal oral habits found were bruxism (47.1%), clenching (40.5%), and others, including cheek biting and lip sucking.

Statistical analysis using Pearson's chi square revealed a relationship between the presence of linea alba buccalis and signs of TMD; abnormal jaw opening patterns and removable denture wearing ($p<0.05$). Moreover, patients who had signs of TMD (such as abnormal oral habits or joint sounds) had a 1.1–1.9 fold higher incidence of linea alba buccalis than those without signs of TMD. Subjects with abnormal jaw opening patterns tended to have a 1.8–3.1 fold higher incidence of linea alba buccalis than those with no abnormal jaw opening patterns (table2).

Table 1 Factors related to TMD in studied population

Factors related to TMD			Number	Percent in total sample group	Percent in group with factors related to TMD
Abnormal habits					
	Normal		741	74.1	
	Abnormal		259	25.9	
		Clenching	105	10.5	40.5
		Bruxism	122	12.2	47.1
		Biting	16	1.6	6.2
		Sucking	7	0.7	2.7
		Other	9	0.9	3.5
Signs of TMD					
	Normal		690	69	
	Abnormal		310	31	
		Unilateral clicking	199	19.9	64.2
		Bilateral clicking	95	9.5	30.6
		Joint pain	16	1.6	5.2
Opening pattern					
			Normal		633
	Abnormal		367	36.7	
		Jaw deviation	309	30.9	84.2
		Jaw deflection	55	5.5	15.0
		Locked jaw	2	0.2	0.5
		Jaw deviation & deflection	1	0.1	0.3
Muscles of mastication problems					
			Normal		983
	Abnormal		17	1.7	
		Don't know site	7	0.7	41.2
		Masseter muscle	4	0.4	23.5
		Temporalis muscle	4	0.4	23.5
		Median pterygoid muscle	2	0.2	11.8

Table 1 (Continued)

Factors related to TMD		Number	Percent in total sample group	Percent in group with factors related to TMD
loss of Posterior teeth				
	no		500	50
yes		500	50	
	1 quadrant	112	11.2	22.4
	2 quadrants	151	15.1	30.2
	3 quadrants	67	6.7	13.4
	4 quadrants	170	17	34.0
Prosthesis Wearing				
fixed prosthesis				
	no		885	88.5
yes		115	11.5	
	single crown	70	7	60.9
	bridge	40	4	34.8
	single crown and bridge	5	0.5	4.3
Removable prosthesis				
	no		926	92.6
yes		74	7.4	
	TP	44	4.4	59.5
	RPD	28	2.8	37.8
	RB	2	0.2	2.7

Table 2 Relationship between the presence of linea alba buccalis and factors related to TMD (Odds Ratio analysis with p=0.05)

Characteristic		Total	Number of linea alba buccalis		OR	95%CI of OR	
			no	yes		Upper	Lower
		1000					
Gender							
	male	366	167	199	1.068	0.824	1.383
	female	634	279	355			
Abnormal habit							
	no	741	343	398	1.305	0.979	1.74
	yes	259	103	156			
Signs of TMD							
	no	690	327	363	1.446	1.1	1.9
	yes	310	119	191			
Opening pattern problem							
	normal	633	330	303	2.357	1.8	3.086
	abnormal	367	116	251			
Muscle of Mastication problem							
	normal	983	436	547	0.558	0.211	1.478
	abnormal	17	10	7			
Loss of posterior teeth problem							
	no	500	222	278	0.984	0.767	1.263
	yes	500	224	276			
Removable prosthesis							
	no	926	404	522	0.590	0.366	0.951
	yes	74	42	32			
Fixed prosthesis							
	no	885	395	490	1.012	0.684	1.496
	yes	115	51	64			

Our study revealed an interesting observation between the presentation of linea alba buccalis and the loss of posterior teeth and wearing dentures. Patients without a removable partial prosthesis developed linea alba buccalis 0.94–1.8 fold higher than patients wearing a removable prosthesis.

Logistic regression analysis demonstrated a relationship between the presentation of linea alba buccalis with abnormal jaw opening patterns, abnormal oral habits, and removable partial denture wearing. These results corresponded with the Pearson's chi-square test and Odds ratio analysis (table3).

Table 3 Logistic regression factors affecting linea alba buccalis

Characteristic	B	S.E.	df	OR	95% C.I. for OR	
					Lower	Upper
Sex	-0.072	0.138	1	0.930	0.710	1.219
Signs of TMD	-0.252	0.149	1	0.777	0.580	1.041
Opening patterns	-0.863	0.143	1	0.422	0.319	0.558
Muscle of mastication	0.739	0.518	1	2.094	0.759	5.779
Loss of posterior teeth	-0.065	0.137	1	0.937	0.716	1.227
Fixed Prosthesis	0.020	0.213	1	1.020	0.671	1.549
Abnormal oral habits	-0.487	0.161	1	0.614	0.448	0.842
Removable Prosthesis	0.585	0.263	1	1.795	1.071	3.007
Constant	-0.419	0.587	1	0.658		

Conclusions and Discussion

Discussion

Buccal mucosa ridging and tongue indentation are clinical manifestations of bruxism and tooth clenching [12-15]. These are hypothesized to be caused by pressure between the buccal mucosa and the buccal surfaces of the adjacent teeth during sleep [16]. Increased intra oral vacuum resulting from the tongue being compressed by the hard palate or the lingual surfaces of the lower teeth has also been shown to be involved in the development of linea alba buccalis [15]. Several reports suggest linea alba buccalis may additionally be caused by chronic irritation from functional chewing, sucking, or other oral habits creating movement of the buccal mucosa [13, 17, 18]. Studies have stated that linea alba buccalis may disappear if the patients cease the parafunctional oral habits [16, 19].

EMG studies of the masseter and buccinator muscles found a correlation between increased intraoral pressure during daily function by these two muscles of mastication and the development of linea alba buccalis. Numerous previous studies focusing on parafuctional oral habits other than bruxism found a relationship between these habits and buccal mucosa ridging or tongue indentation. These concluded

that bruxism is not the only factor affecting the development of linea alba buccalis [20-22].

Okeson [23] and Gavish; et al. [24] reported that if parafunctional habits do not exceed individual physiologic tolerance they will not cause TMD. However, some reports claim that parafunctional oral habits can lead to increased pain in TMD. Tooth grinding and clenching are reported as the most common parafunctional habits affecting the development of TMD [6]. Laboratory studies [25-27] indicate tooth clenching and grinding also causes TMD signs such as muscular fatigue, pain, jaw stiffness, and TMJ sounds. Moreover, the severity of TMD is reported to be increased by nocturnal grinding [18, 28, 29], suggesting patients who suffer from TMD should be treated by using occlusal splints during nighttime sleeping. Currently, however, the mechanisms of how parafunctional habits affect the development ofTMD are still unclear.

The present study found a relationship between abnormal opening patterns and muscles of mastication problems with TMD consistent with a report by Nilner [30], but different from that of Piquero et al [1] that found no relationship between TMD and muscle of mastication problems. We found there is a correlation between the presentation of linea alba buccalis and TMD, as did a previous study indicating 47% of TMD patients also had linea alba buccalis present [31].

Focusing on the sex of the individual, a number of studies report that females tend to attend pain clinics more than males and the perception of pain, frequency of individual pain, and intensity of pain are also higher in females than in males [32-34]. A study has suggested that females have a lower pain threshold and pain tolerance than males [35]. Previous data showed the incidence of TMD was 8-15% in females and 3-10 % in males. Also, In individuals 35–45 years of age, females tended to have a 1.5-2 fold higher risk of TMD than males [36].

Previous epidemiologic studies focusing on sex and pain associated with TMD were descriptive studies suggesting sociodemographic influences on TMD pain other than sex. Subsequent studies utilized questionnaire analysis and direct interview to expand on their findings. However, a drawback to these are that they rely on the patient's subjective descriptions of the pain, and can also be influenced by examiner bias [33, 35, 37, 38].

Studies based on hormonal effects that may lead to differences between the sexes in pain perception claimed that female pain levels increased during the reproductive cycle or while taking oral contraceptives [36, 39, 40]. According to the in vivo studies by Milam; et al. [41] and Aufdemorte; et al. [42] on the relationship between TMD and estrogen receptors, the TMJ of females have higher levels of the estrogen receptor than those of males [43]. Abubaker; et al. [44] found that protein and collagen composition in the TMJ disc were affected by sex hormones. Several studies investigated the effect of estrogen on relaxin, which causes tissue degradation in the TMJ. Increased relaxin levels were associated with systemic joint hypermobility and TMD [45-47].

In the present study, we found a relationship between sex and TMD, with females more commonly affected ($p<0.05$). However, the relationship between sex and abnormal muscle of mastication or abnormal jaw opening patterns was not statistically significant. The data revealed different incidences of linea alba buccalis between the sexes. In males, linea alba buccalis was found 1.25 fold more than in females. This is in contrast to Piquero; et al. [1] who reported a higher incidence of linea alba buccalis in females than males.

Many studies have focused on denture wearing and the loss of posterior teeth among populations not receiving tooth replacement and TMD. Although, the loss of posterior teeth without tooth replacement can cause an abnormal occlusion system, there is still no evidence to support a relationship between TMD and denture wearing [1, 48, 49, 50].

Conclusions

The present study has found a relationship between the presence of buccal mucosa ridging (linea alba buccalis) and removable partial denture wearing and abnormal jaw opening patterns ($p<0.05$). However, a relationship between sex and the presence of linea alba buccalis was not found ($p>0.05$). Our study suggests that the clinical presentation of linea alba buccalis might be used as a clinical aid for TMD diagnosis. These findings may be applied in clinical examinations and may be of practical use when diagnosing asymptomatic TMD. We plan further clinical evaluation in the TMD Clinic to obtain conclusive data between the clinical manifestation of linea alba buccalis and TMD.

Acknowledgements

This research was supported by the research fund budget, Srinakharinwirot University, budget year 2007.

References

[1] Piquero, K.; Ando, T.; & Sakura, K. (1999). Buccal mucosa ridging and tongue indentation: Incidence and associated factors. *Bull Tokyo Dent Coll*. 40: 71-78.

[2] Piquero, K.; & Sakurai, K.A. (2000). Clinical diagnosis of diurnal (non-sleep) bruxism in denture wearers. *J. Oral Rehabil*. 27: 473-482.

[3] Takagi, I.; & Sakurai, K. (2003). Investigation of the factors related to the formation of the buccal mucosa ridging. *J. Oral Rehabil*. 30: 565-572.

[4] Amemori, Y.; et al. (2001). Influence of nocturnal bruxism on the stomatognathic system. Part I: a new device for measuring mandibular movements during sleep. *J. Oral Rehabil*. 28: 943-949.

[5] Glaros, A.G.; Tabacchi, K.N.; & Glass, E.G. (1998). Effect of parafunctional clenching on TMD pain *J Orofac Pain*. 12: 145-152.

[6] Glaros, A.G.; et al. (2000). Effect of parafunctional clenching on temporomandibular disorder pain and proprioceptive awareness. *Cranio*. 18: 198-204.

[7] Magnusson, T.; Egermark, I.; & Carlsson, G.E. (2000). A longitudinal epidemiologic study of signs and symptoms of temporomandibular disorders from 15 to 35 years of age. *J Orofac Pain.* 14: 310-319.

[8] Pahkala, R.H.; & Laine –Alava, M.T. (2002). Do early signs of orofacial dysfunctions and occlusal variables predict development of TMD in adolescence?. *J Oral Rehabil.* 29: 737-743.

[9] Egermark, I.; Carlsson, G.E.; & Magnusson, T. (2001). A 20-year longitudinal study of subjective symptoms of temporomandibular disorders from childhood to adulthood. *Acta Odontol Scand.* 59: 40-48.

[10] Klemetti, E. (1996). Signs of temporomandibular dysfunction related to edentulousness and complete dentures: an anamnestic study. *Cranio.* 14: 154-157.

[11] Marciani, R.D.; Haley, J.V.; & Roth, G.I. (1985). Facial pain complaints in the elderly. *J Oral Maxillofac Surg.* 43: 173-176.

[12] Sapiro, S.M. (992). Tongue indentation as an indicator of clenching. *Clinical Preventive Dentistry.* 14: 21-24.

[13] Gary, C.C.; & John, F.N. (1993). Principal of oral diagnosis. USA: Mosby.

[14] Kampe, T.; et al. (1997). Reported symptoms and clinical findings in a group of subjects with long standing bruxing behaviour. *J Oral Rehabil Journal.* 24: 581-587.

[15] Long, J.H. (1998). A device to prevent jaw clenching. *J Pros Dent.* 79: 353-354.

[16] Gray, R.J.M.; Davies, S.J.; & Quayle, A.A. (1994). A clinical approach to temperomandibular disorder: Examination of the articulatory system: The muscles. *British Dent J.* 177: 25-28.

[17] Malcolm, A.L. (1994). Oral Medicine. Philadelphia: J.B. Lippincott.

[18] Rugh, J.D.; & Harlan, J. (1988). Nocturnal bruxism and temperomandibular disorders. Advance in Neurology. New York: Raven Press.

[19] Pindborg, J.J. (1992). Atlas of oral diseases of the oral mucosa. Philadelphia: W.B. Saunders.

[20] Victor, H.S. (1960). Cheek biting. *JADA.* 65: 479-481.

[21] Sewerin, I.B. (1971). A clinical and epidemiologic study morsicatio buccarum/labiorum. Scand. *J Dent Res.* 79: 73-80.

[22] VanWyk, C.W.; Staz, J.; & Farman, A.G. (1977). The chewing lesion of the cheeks and lips: its features and prevalence among a selected group of adolescents. *J Dent.* 5:193-199.

[23] Okeson, J.P. (1993). Management of Temperomandibular Disorders and Occlusions. St. Louis: Mosby.

[24] Gavish, A. (2000). Halachmi M, Winocur E, Gazit E. Oral habits and their association with signs and symptoms of temporomandibular disorders in adolescent girls . *J Oral Rehabil.* 27: 22-32.

[25] Christensen, L.V. (1971). Facial pain and internal pressure of masseter muscle in experimental bruxism in man. *Arch Oral Biol*. 16: 1021-2107.

[26] Christensen, L.W. (1981). Jaw muscle fatigue and pains induced by experimental tooth clenching; a review. *J Oral Rehabil*. 78: 27.

[27] Clark, G.T.; Jow, R.W.; & Lee, J.J. (1989). Jaw pain and stiffness levels after repeated maximum voluntary cleching. *J Dent Res*. 68: 69.

[28] Drucko, P.N.; et al. (1990). Prevalence of temperomandibular symptoms in a large United States metropolitan area. *J Cranio Pract*. 8: 131.

[29] Rugh, J.D. (1992). Association between bruxism and TMD. Current Controversies in Temperomandibular Disorders. Chicago: Quintessence.

[30] Nilner, M. (1983). Relationships between oral parafunctions and functional disturbances in the stomatognathic system among 15-18 year-olds. *Acta Odontol Scand*. 41: 197-201.

[31] Arnold, S.; & Franks, T. (1965). Masticatory muscle hyperactivity and temperomandibular joint dysfunction. *J Pros Dent*. 15: 1122-1130.

[32] Von Korff, M.; et al. (1988). An epidemiologic comparisons of pain complaints. *Pain*. 32: 173-183.

[33] Unruh, A.M. (1996). Gender variations in clinical pain experience. *Pain*. 65: 123-167.

[34] Andersson, H.I.; et al. (1993). Chronic pain in a geographically defined general population: Studies of differences in age, gender, social class, and pain localization. *Clin J Pain*. 9: 174-182.

[35] Berkley, K.J. (1997). Sex differences in pain. *Behav Brain Sci* . 20: 371-380.

[36] LeResche, L. (1997). Epidemiolgy of temperomandibular disorders: Implications for the investigation of etiologic factors. *Crit Rev Oral Biol Med*. 8: 291-305.

[37] Weir, R.; et al. (1996). Gender differences in psychosocial adjustment to chronic pain and expenditures for health care services used. *Clin J Pain*. 12: 277-290.

[38] Fillingim, R.B.; & Maixner, W. (1993). Gender differences in a responsiveness to painful and non-painful stimuli are dependent upon the stimulation method. *Pain* . 53: 255-264.

[39] Dao, T.T. (2000). Gender differences in pain. *J orofac pain*. 14: 169-184.

[40] LeResche, L.; et al. (1993). Does oral contraceptive use increase the risk of temperomandibular (TMD) pain?. In *IASP Scientific Program Committee. 7th World Congress on Pain: Abstracts: August 22-27, 1993.* n.p.: IASP Publications

[41] Milam, A.B.; et al. (1987). Sexual dimorphism in the distribution of estrogens receptors in the temperomandibular joint complex of the baboon. *Oral Surg Oral Med Oral Pathol*. 64: 532-32.

[42] Aufdemorte, T.B.; et al. (1986). Estrogen receptors in the temperomandibular joint of the baboon (*Papio cynocephalus*): An autoradiographic study. *Oral Surg Oral Med Oral Pathol*. 61: 307-314.

[43] Abubaker, A.O.; Raslan, W.F.; & Sotereanos, G.C. (1993). Estrogen and progesterone receptors in temperomandibular joint discs of symptomatic and asymptomatic persons: A preliminary study. *J Oral Maxillofac Surg*. 51: 1096-1100.

[44] Abubaker, A.O.; Hebda, P.C.; & Gunsolley, J.N. (1996). Effects of sex hormones on protein and collagen content of the temperomandibular joint discs of the rat. *J Oral Maxillfac Surg*. 54: 721-727.

[45] Bates, R.E.; Stewart, C.M.; & Atkinson, W.B. (1984). The relationship between internal derangements of the temperomandibular joint and systemic joint laxity. *JADA.* 109: 446-7.

[46] Westling, L. (1989). Craniomandibular disorders and general joint mobility. *Acta Odontol Scand*. 47: 293 -299.

[47] Westling, L.; Carlsson, G.E.; & Helkimo, M. (1990). Background factors in craniomandibular disorders with special reference to general joint hypermobility, parafunction, and trauma. *J Cranio Dis Fac Pain*. 4: 89-98.

[48] De Boever, J.A. (2000). Need for occlusal therapy and prosthodontic treatments in emporomandibular therapy. Part I occlusal interference and occlusal adjustment. *J Oral Rehabil*. 27: 647-659.

[49] De Boever, J.A.; Carlsson, G.; & Klineberg, M. (2000). Need for occlusal therapy and prosthodontic treatments in temporomandibular therapy. Part II occlusal interference and occlusal adjustment. *J Oral Rehabil*. 27: 367-379.

[50] Dervise, E. (2004). Changes in temporomandibular disorders after treatment with complete denture. *J Oral Rehabil*. 4: 320-326.