Hormonal Fluctuations Intensify Temporomandibular Disorder Pain Without Impairing Masticatory Function

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Purpose: The influence of hormonal fluctuations on pain and mastication was evaluated in patients with painful temporomandibular disorder (TMD) symptoms. ***Materials and Methods:*** Fifty women were assigned to menstrual cycle and oral contraceptive groups (n = 25). Their TMD was diagnosed by Research Diagnostic Criteria for Temporomandibular Disorders. Pain levels, maximum oclusal force (MOF), and masticatory performance (MP) were measured in all menstrual cycle phases. ***Results:*** A lower pain level was observed in the ovulatory phase when compared to menstrual and luteal phases ($P = .02$). No differences were found regarding MOF ($P = .20$) or MP ($P = .94$). ***Conclusions:*** Hormonal fluctuations intensify pain in women with symptomatic TMD without impairing mastication. *Int J Prosthodont 2015;28:72–74. doi: 10.11607/ijp.4040*

Painful temporomandibular disorders (TMDs) can impact patients' quality of life, and women are 1.5 to 2 times more likely to suffer from TMD.[1,2] Pain onset also occurs during reproductive age, and high-affinity estrogen receptors were detected in TMD patients.[1] Estrogen enhances the enzymatic activity of lipid oxidizing muscle fiber, thereby increasing the force of maximal isometric contraction that could ultimately interfere with muscle function.[1] The authors' previous study[3] evaluating women with painless disc displacement revealed no changes in mastication during menstrual cycle. As pain intensity increases at times of low or sudden drops in estrogen levels,[2] it could be hypothesized that pain is a key factor for masticatory muscle dysfunction. This study evaluated whether hormonal fluctuations in the menstrual cycle could alter pain level, maximum occlusal force (MOF), and masticatory performance (MP) in women with painful TMD.

Materials and Methods

Dentate women with painful TMD symptoms who had no malocclusion or parafunctional habits were selected. TMD was diagnosed by Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) and participants were placed in one of two groups.[3] Subjects signed the consent form approved by Ethics Committee of Piracicaba Dental School (protocol no. 015/2011). Women who were pregnant, at menopause, wearing dental prostheses, presenting with hormonal disease, undergoing fertility treatment, or experiencing no TMD pain were excluded. Sample size was estimated based on previous data.[3] The final sample comprised 50 women assigned to two groups (n = 25): menstrual cycle (MC; mean age: 24.7 ± 6.2 years) and oral contraceptive (OC; control) (mean age: 29.2 ± 7.4). The OC group complied with a 21-day regime of low-dose estrogen and progesterone pills. Women with regular menstrual cycles, varying between 24 and 32 days, should be free of OC use. OC group participants were evaluated once a week for 1 month (four assessments) with first assessment carried out during interval time (bleeding). The MC

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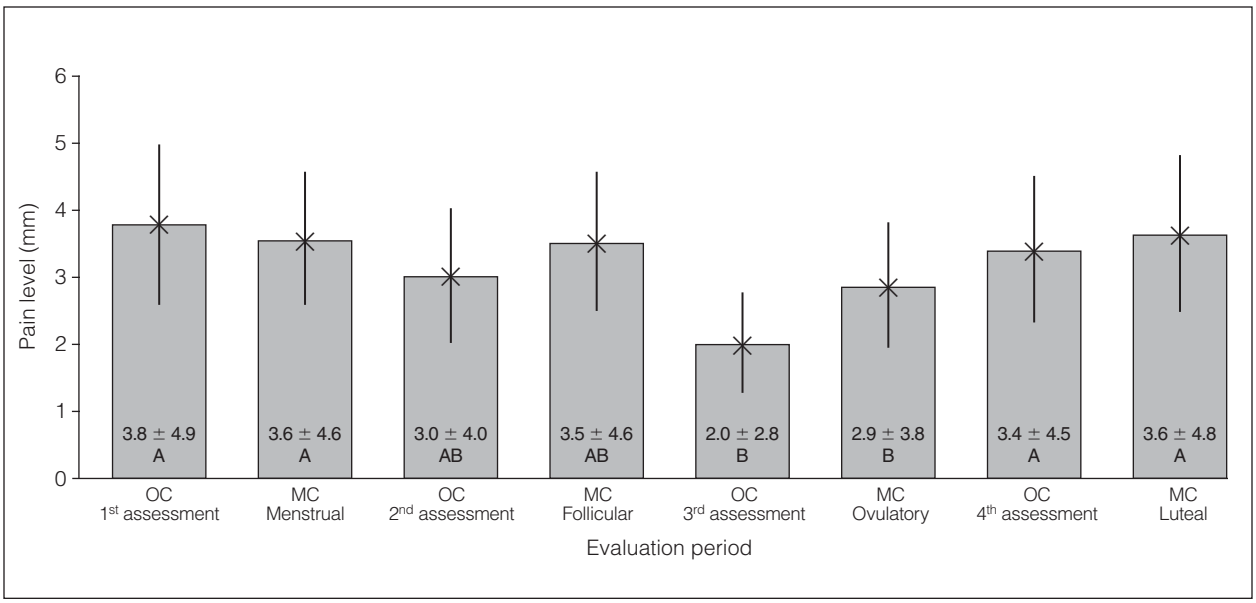

Fig 1 Mean ± SD values for pain level measured by visual analog scale according to groups and evaluation periods. Distinct letters indicate significant differences by repeated ANOVA and Tukey test measures (F = 3.37; *P* = .02).

group was assessed in all phases of one complete menstrual cycle. Based on a 28-day menstrual cycle, phases were defined as menstrual (bleeding): days 1 to 5; follicular: days 6 to 10; ovulatory: days 12 to 16, confirmed by ovulation prediction test (BioEasy Diagnóstica, Belo Horizonte); and luteal: days 21 to 28. Adjustments were performed for cycles longer or shorter than 28 days.[3]

Pain level was rated on a visual analog scale (VAS), ranging from 0 (no pain) to 10 (worst pain imaginable). MOF was measured twice with a transducer (Spider 8, Hottinger Baldwin Messtechnik) and sensors bilaterally placed on first molars. Subjects were requested to occlude with maximum force (7 seconds). Highest values recorded were used and expressed in KgF.[3] MP was evaluated by Optosil chewing and sieving method.[3] Median particle size (X_{50}) was calculated.[3]

Repeated-measures analysis of variance (ANOVA) and the Tukey-Kramer tests were used to analyze data using GLIMMIX SAS System (Release 9.2, SAS Institute) (α = .05).

Results

The lowest pain was observed in the ovulatory phase for the MC group and third assessment for the OC group (*P* = .02; Fig 1). No differences in MOF and MP were noticed regarding menstrual cycle phases for both groups (*P* > .05; Table 1). The MC group showed higher MOF values than the OC group (*P* = .007; Table 2).

Table 1 F Values (*P*) for Pain Level, Maximum Occlusal Force (MOF), and Masticatory Performance (MP) by Generalized Linear Mixed Model for Repeated Analysis of Variance Measures (α = .05)

Effect	Pain	MOF	MP
Group	0.83 (.36)	5.91 (.01)	1.46 (.23)
Phase	3.37 (.02)	1.53 (.20)	0.15 (.93)
Group Phase	0.83 (.47)	0.55 (.65)	1.25 (.29)

Table 2 Maximum Occlusal Force (KgF) in Menstrual Cycle (MC) and Oral Contraceptive (OC) Groups*

Group	Mean ± SD	F	*P*
OC	39.59 ± 10.62	8.10	.007
MC	46.52 ± 11.09		

*Analysis of variance generalized by a linear mixed model, Tukey honestly significant difference (α = .05).

Discussion

Questions arise about whether painful symptoms might be modulated by hormones, which could ultimately alter the masticatory function. The authors showed that TMD pain varied during one menstrual cycle, increasing in the luteal and menstrual phases when compared to ovulation. In the OC group, TMD pain also increased at the OC interval time. Similar

findings were previously reported, showing an increased facial pain associated with lower estrogen levels.[2] This might explain why patients with painful TMD symptoms are more likely to be affected by estrogen fluctuations.

Although changes in TMD pain were observed, no differences were found in MOF or MP. These findings were unexpected since an impaired masticatory function is a common complaint among patients with TMD.[4] In the authors' previous study[3] with painless TMD patients, similar results for MOF and MP were found regarding the menstrual cycle. In addition, hormone fluctuation seems to have no effect on the performance of several body muscles.[5] Thus, it can be suggested that, although the fluctuating estrogen intensifies TMD pain, masticatory muscle function is not affected.

Conclusions

Pain levels of TMD in women are influenced by hormonal fluctuations of the menstrual cycle without interference with their masticatory function.

Acknowledgments

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References

1. Warren MP, Fried JL. Temporomandibular disorders and hormones in women. Cells Tissues Organs 2001;169:187–192.
2. LeResche L, Mancl L, Sherman JJ, Gandara B, Dworkin SF. Changes in temporomandibular pain and other symptoms across the menstrual cycle. Pain 2003;106:253–261.
3. Goncalves TM, Sanchez-Ayala A, Ambrosano GM, Garcia RC. Female hormonal fluctuation and masticatory function in patients with disc displacement—A case-control study. Int J Prosthodont 2011;24:320–327.
4. Peroz I, Tai S. Masticatory performance in patients with anterior disk displacement without reduction in comparison with symptom-free volunteers. Eur J Oral Sci 2002;110:341–344.
5. Janse de Jonge XA, Boot CR, Thom JM, Ruell PA, Thompson MW. The influence of menstrual cycle phase on skeletal muscle contractile characteristics in humans. J Physiol 2001;530:161–166.

Literature Abstract

Influence of smoking on clinical parameters and gingival crevicular fluid volume in patients with chronic periodontitis

This in vitro study compared the clinical periodontal disease parameters and gingical crevicular fluid (GCF) volume of smokers and nonsmokers with chronic periodontitis. Smokers were defined as those who smoked ≥ 20 cigarettes per day for > 2 years. The smoking and nonsmoking group each had 30 male subjects ages 20 to 35 years, with periodontal probing depth (PPD) ≥ 4 mm and clinical attachment loss ≥ 2 mm in at least 30% of teeth. One examiner measured PPD, clinical attachment level (CAL), Plaque Index (PI) and bleeding on probing (BOP) with Williams periodontal probe, as well as GCF volume with a Periotron 8000 (Ora*flow*) at six sites of each selected teeth. The authors reported that compared to nonsmokers, smokers had significantly higher PPD (4.64 ± 0.30 mm versus 4.24 ± 0.38 mm), CAL (3.08 ± 0.28 mm versus 2.74 ± 0.42 mm) and PI (74.90 ± 9.89% versus 67.63 ± 15.48%), but significantly lower BOP (60.20 ± 17.14% versus 72.43 ± 15.49%) and GCF volume (0.25 + 0.04 µl versus 0.31 + 0.05 µl). No significant difference in GCF volume between the lingual and facial sites of smokers' teeth was detected. The authors concluded that smoking might affect the inflammatory process of the periodontium, promoting periodontal disease.

Mokeem SA, Vellappally S, Preethanath RS, Hashem MI, Al-Kheraif AA, Sukumaran A. *Oral Health Dent Manag* 2014;13:469–473. **References:** 45. **Reprints:** Anil Sukumaran, Department of Periodontics and Community Dentistry, College of Dentistry, King Saud University, Riyadh, Saudi Arabia. Email: drsanil@gmail.com—*Simon Ng, Singapore*