

Orthodontics and the Temporomandibular Joint

CHARLES S. GREENE

Dr. Greene is Professor of Oral and Maxillofacial Surgery and Research Coordinator of the Temporomandibular Joint and Facial Pain Research Center at the University of Illinois College of Dentistry. He is a dental graduate (D.D.S.) of the University of Illinois.

A review of the multiple factors involved in temporomandibular joint function and dysfunction, together with research findings that suggest a minor role for occlusal modification in the management of myofascial pain dysfunction syndrome associated with the temporomandibular joint.

Address:

Dr. Charles S. Greene
TMJ and Facial Pain Center
University of Illinois
College of Dentistry
P.O. Box 6998
Chicago, IL 60680

*Read at the Conference on the Temporomandibular Joint sponsored by the American Association of Orthodontists Foundation in Dallas, Texas, January, 1981.
Supported by Research Grant No. PHS DE-5679-09*

The diagnosis and treatment of various developmental, pathologic, and functional disorders of the temporomandibular joint (TMJ) have become largely the responsibility of the dental profession. Despite the many similarities between disorders of the TMJ and those of other joints, the medical profession seldom becomes involved in the management of these problems beyond prescription for pain relief or surgical intervention.

Within the dental profession, no single category of practitioner has earned a dominant position in the management of these disorders. Dentists in all areas of practice may see TMJ patients, and they should be adequately prepared for dealing with them.

However, the old quip that "What happens to a patient depends on what floor the elevator in the professional building stops at" very aptly describes both the predicament of the TMJ patient and the current problem within

our profession. Each patient gets a diagnosis and treatment based on concepts known to and favored by the practitioner he happens to consult, and those concepts are obviously dependent on professional background and training.

Needless to say, the specialty of orthodontics has its own TMJ concepts related to orthodontic diagnosis and treatment. Many of these ideas are based on the writings of such orthodontists as Thompson,¹ Perry,² Ricketts,³ Graber,⁴ Roth,⁵ and others.

It is sometimes stated that orthodontic correction of malocclusion relationships may either reduce the likelihood of later development of TMJ dysfunction or be therapeutic for those who have already developed signs and symptoms of TMJ dysfunction. The purpose of this paper is to consider the validity of these two ideas, and to discuss some of the other concepts in this area which may be of interest to orthodontists.

RESEARCH FINDINGS

A great deal of research with TMJ patients has been conducted during the past 25 years, but little has been related specifically to orthodontic therapy. Physiologic research involv-

ing electromyography (EMG) has been reported by orthodontists such as Moyers,⁶ Perry,⁷ Pruzansky,⁸ and Jarak.⁹ Developments in the area of TMJ radiography have come from Ricketts¹⁰ and Williamson,¹¹ and extensive epidemiologic studies of functional disturbances have been conducted by Ingervall¹² and others.

However, most reports concerning direct relationships between orthodontic treatment and the prevention or treatment of TMJ symptomatology have been anecdotal.

This gap in the orthodontic research literature was addressed by a long-term study reported recently by Sadowsky and BeGole.¹³ These authors evaluated data collected from a study of 96 former orthodontic patients who were examined between 10 and 35 years after completion of treatment. The patients were compared with a matched group of controls who did not receive orthodontic therapy.

The preliminary analysis of TMJ data on 75 of those patients was reported in the article cited above, and a final version has been submitted to the United States Public Health Service, National Institute of Dental Research, National Institutes of Health.¹⁴

Tables 1 and 2 show their findings on TMJ symptomatology and func-

TABLE 1

Temporomandibular Joint Signs and Symptoms in Orthodontic and Control Groups.

<i>Signs or Symptoms</i>		<i>Orthodontic</i>	<i>Control</i>	χ^2
Pain or tenderness presently or previously	Absent	82	81	1.53
	Present	14	22	
	Totals	96	103	
Joint Sounds	Absent	63	60	1.13
	Present	33	43	
	Totals	96	103	

Adapted with permission from Sadowsky, C. et al.: Research study on the long-term effects of orthodontic treatment. Prepared for NIDR, NIH, Bethesda, Md., 1980.

tional occlusal relationships. Their major conclusions were:

In patients who had undergone orthodontic treatment many years previously, the prevalence of TMJ signs/symptoms is similar to that in a control group with untreated malocclusion.

A similar high incidence of non-functional occlusal contacts occurred in both orthodontically treated and control groups.

No relationship was evident between signs or symptoms of TMJ dysfunction and the presence of nonfunctional occlusal contacts or mandibular shifts.¹⁴

Meanwhile, during the past 16 years our research group at the University

of Illinois Temporomandibular Joint and Facial Pain Research Center has been conducting a series of studies (independent of the Orthodontic Department) in which we have evaluated various aspects of diagnosis, etiology, and treatment of TMJ disorders. While space does not permit a full review of those activities, some of our findings are germane to the questions under consideration here.

Table 3 shows an occlusal classification of our patient population, the clinic population from the Columbia University Facial Pain Clinic, and the United States Public Health Service norms for these parameters. A direct comparison is hampered somewhat by the fact that the United States

TABLE 2
Tooth Contacts During Mandibular Movement in Orthodontic and Control Groups

		Orthodontic (96)	Control (103)	χ^2
Right working contacts				
Cuspid rise		23	11	6.33*
Group function		72	90	
Neither		1	2	
Left working contacts				
Cuspid rise		22	25	0.05
Group function		73	77	
Neither		1	1	
Right non-working contacts				
	Absent	24	28	0.12
	Present	72	75	
Left non-working contacts				
	Absent	19	25	0.58
	Present	77	78	
Posterior contact on protrusion				
	Absent	48	50	0.04
	Present	48	53	

* Statistically significant $p < 0.05$.

Adapted with permission from Sadowsky, C. et al.: Research study on the long-term effects of orthodontic treatment. Prepared for NIDR, NIH, Bethesda, Md., 1980.

Public Health Service figures do not separate normal occlusion from Class I malocclusion, and also by the absence of information on anterior tooth relationships in the Class III malocclusion subjects. Nevertheless, a gross inspection of this table reveals that the distribution of the three major categories of occlusal relationship is similar in all three populations.

This finding, along with those of Thomson,¹⁵ Solberg¹⁶ and Posselt,¹⁷ showed no major occlusal distinctions between symptomatic TMJ patients and randomly selected people. This point is also strongly supported by the observation of many orthodontists and oral surgeons that patients presenting for orthognathic surgery rarely complain of pain or dysfunction of the TMJ in spite of their extreme occlusal discrepancies.

Our investigations into the etiology of the myofascial pain-dysfunction (MPD) syndrome, which is our term for the major functional disorder of the TMJ, have demonstrated the important role that psychological stress and muscular hyperactivity can play in the development of this muscular disorder.¹⁸⁻²⁰

Our studies regarding treatment of the MPD syndrome have demonstrated the importance of the doctor-patient relationship,²⁴ the efficacy of different kinds of conservative therapy,²⁵ and the strong influence of placebo effects which are present in every kind of therapy for this disorder.²¹⁻²³ We have reported on the results of our various therapeutic methods over a long period of time.²⁶⁻²⁸

If more than three of every four MPD patients respond favorably to a variety of reversible or irreversible treatments (as we have shown that they do), and most of them continue to do well over long periods of time, there seems to be little justification for routine use of the more radical irreversible approaches.

We have therefore concluded that irreversible occlusal therapy, whether accomplished by equilibration, prosthodontics or orthodontics, should not be regarded as a specific or definitive treatment for the MPD syndrome.

IMPLICATIONS FOR ORTHODONTISTS

The results of these and other studies that were reported during the past 20 years have some important impli-

TABLE 3
Distribution of Major Occlusal Morphologic Types in the Normal Population and Two Patient Groups.

	Youths Age 12-17*	Columbia Facial Pain Center Patients	University of Illinois TMJ & Facial Pain Center Patients
Normal	{ 54†	28	46
Class I Malocclusion	{	39	33
Class II Malocclusion	32	25	13
Class III Malocclusion	14‡	3	3

* Taken from "Vital and Health Statistics, Series II—#162, An Assessment of the Occlusion of the Teeth of Youths 12-17 years." U. S. Dept. of HEW, 1977.

† Normal and Class I malocclusion not separated.

‡ Molar relationship data; in anterior region only 2.5% had Class III relationship.

cations for orthodontists. For one thing, it seems clear that the assumption that orthodontic correction of dental or skeletal malocclusions will reduce the chances of developing TMJ disorders in the future is not supported by the statistical data.¹³

Of course, one can also look at the bright side of this data to conclude that orthodontists are not generally increasing the risk of their patients developing such disorders. This is contrary to views such as those espoused by Roth^{5,29} and Chiappone,³⁰ which suggest that orthodontists should accept specific philosophies that require finishing cases in one particular manner.

A second conclusion from the research cited here is that orthodontic treatment cannot be regarded as a specific therapy for the MPD syndrome. A person presenting with symptoms of this disorder in combination with a structural malocclusion should not be advised to undergo orthodontic treatment for either short-term relief from symptoms or as a preventive long-term therapy.

This does not mean that the person should not receive orthodontic treatment at all, but simply that it should not be presented as a definitive TMJ correction. The same is true for full-mouth reconstruction. Either treatment may be needed or desired for various other reasons, but not specifically as TMJ therapy.

INTRA-TREATMENT TMJ PROBLEMS IN ORTHODONTIC PATIENTS

Some orthodontists have expressed concern about the fact that their patients occasionally developed symptoms of MPD or clicking in the TMJ during orthodontic treatment. These phenomena are seen more frequently in adult patients, and may be attributed to effects of treatment exceeding

the adaptive capacity of the muscles and joints. Fortunately, children are more resilient in this regard, and rarely complain of such problems. Resolution requires reduction or elimination of the mechanical factors and possibly conservative occlusal adjustments to permit the patient to assume normal jaw closure and function.

OTHER ORTHODONTIC CONSIDERATIONS

Orthodontists have several important roles to play in the prevention and management of TMJ disorders other than the MPD syndrome. They must work with a variety of developmental facial anomalies in children, many of which involve the temporomandibular joint complex. They must also share responsibility with oral and maxillofacial surgeons in the management of adult orthognathic surgery cases, with obvious implications for TMJ adaptation and function.

In order to fulfill these roles properly, orthodontists must continue, as they have done so well in the past, to be fully informed about normal and abnormal growth and development of the TMJ. The potential as well as the limitations of growth and adaptability of the TMJ and of the teeth, and their interplay in function, can be critical factors in these cases. It is important that orthodontists maintain a constant awareness of these factors in order to produce orthodontic treatment results that are most compatible with normal TMJ function.

Many patients will present directly to orthodontists, or will be referred to them, seeking consultation for various TMJ disorders. To care for these patients most effectively requires enough knowledge about the three major categories of disorders (pathologic, anatomic derangement and functional) to make preliminary diagnostic judg-

ments, communicate with the patient about them, and then either treat or refer them to the appropriate professional when necessary.

The entire field of TMJ problems has become increasingly complex in recent years, and orthodontists can contribute a significant share in fulfilling the dental profession's responsibility for the management of these

disorders. In order to do so effectively, they should remain aware that their fundamental training in growth, development and orthodontic diagnosis and treatment must often be augmented by a familiarity with neurophysiologic mechanisms, muscular dysfunction, stress reduction, chronic pain, and other dimensions of contemporary knowledge in this area.

REFERENCES

1. Thompson, J. R.: Temporomandibular disorders: diagnosis and treatment. In Sarnat, B. G. (Ed.) *The Temporomandibular Joint*, ed. 2, Springfield, Ill. 1964. Charles C. Thomas.
2. Perry, H. T.: Relation of occlusion to temporomandibular joint dysfunction: the orthodontic viewpoint, *J. Am. Dent. Assoc.* 79:137-141, 1969.
3. Ricketts, R. M.: Occlusion—the medium of dentistry, *J. Prosthet. Dent.* 21:39-60, 1969.
4. Graber, T. M.: Overbite—the dentist's challenge, *J. Am. Dent. Assoc.* 79:1135, 1969.
5. Roth, R. H.: Temporomandibular dysfunction and occlusal relationships, *Angle Orthod.* 43:136-153, 1973.
6. Moyers, R. E.: An electromyographic analysis of certain muscles involved in temporomandibular movement, *Am. J. Orthod.* 36:481-515, 1950.
7. Perry, H. T.: Muscular changes associated with temporomandibular joint dysfunction, *J. Am. Dent. Assoc.* 54:614, 1957.
8. Pruzansky, S.: Application of electromyography to dental research, *Am. J. Orthod.* 44:49-58, 1952.
9. Jarabak, J. R.: An electromyographic analysis of muscular and temporomandibular joint disturbances due to imbalances in occlusion, *Angle Orthod.* 26:170-190, 1956.
10. Ricketts, R. M.: Roentgenography of the temporomandibular joint. In Sarnat, B. G. (Ed.) *The Temporomandibular Joint*, ed. 2, Springfield, Ill., 1964, Charles C. Thomas.
11. Williamson, E. H.: Laminagraphic study of mandibular condyle position when recording centric relation, *J. Prosthet. Dent.* 39:561-564, 1978.
12. Ingervall, B., and Hedegard, B.: Subjective evaluation of functional disturbances of the masticatory system in young Swedish men, *Community Dent. Oral Epidemiol.* 2:149-152, 1974.
13. Sadowsky, C., and BeGole, E. A.: Long-term status of temporomandibular joint function and functional occlusion after orthodontic treatment, *Am. J. Orthod.* 78:201-212, 1980.
14. Sadowsky, C., et al.: Research study on the long-term effects of orthodontic treatment. Prepared for NIDR, NIH, Bethesda, Md., 1980.
15. Thomson, H.: Mandibular joint pain: A survey of 100 treated cases, *Brit. Dent. J.* 107:243, 1959.
16. Solberg, W. K., et al.: Temporomandibular joint pain and dysfunction: A clinical study of emotional and occlusal components, *J. Prosthet. Dent.* 28:412, 1972.
17. Posselt, U.: The temporomandibular joint syndrome and occlusion, *J. Prosthet. Dent.* 25:432, 1971.
18. Lupton, D. E.: Psychological aspects of temporomandibular joint dysfunction, *J. Am. Dent. Assoc.* 79:131-136, 1969.
19. Evaskus, D. S., and Laskin, D. M.: A biochemical measure of stress in patients with myofascial pain-dysfunction (MPD) syndrome, *J. Dent. Res.* 51:1464-66, 1972.

20. Mercuri, L. G., Olson, R. E., and Laskin, D. M.: The specificity of response to experimental stress in patients with myofascial pain-dysfunction syndrome, *J. Dent. Res.* 58:1866-71, 1979.
21. Greene, C. S., and Laskin, D. M.: Meprobamate therapy for the myofascial pain-dysfunction (MPD) syndrome: A double-blind evaluation, *J. Am. Dent. Assoc.* 82:587-90, 1971.
22. Greene, C. S., and Laskin, D. M.: Splint therapy for the myofascial pain-dysfunction (MPD) syndrome: A comparative study, *J. Am. Dent. Assoc.* 84:624-628, 1972.
23. Goodman, P., Greene, C. S., and Laskin, D. M.: Response of patients with myofascial pain-dysfunction syndrome to mock equilibration, *J. Am. Dent. Assoc.* 92:755-758, 1976.
24. Laskin, D. M., and Greene, C. S.: Influence of the doctor-patient relationship on placebo therapy for patients with myofascial pain-dysfunction (MPD) syndrome, *J. Am. Dent. Assoc.* 85:892-894, 1972.
25. Greene, C. S.: Myofascial pain-dysfunction syndrome: nonsurgical treatment. In Sarnat, B. G., and Laskin, D. M. (Eds.). *The Temporomandibular Joint—A Biological Basis for Clinical Practice*, ed. 3, Springfield, Ill., 1980, Charles C Thomas.
26. Greene, C. S., and Laskin, D. M.: Long-term evaluation of conservative treatment for myofascial pain-dysfunction syndrome, *J. Am. Dent. Assoc.* 89:1365-1368, 1974.
27. Greene, C. S., and Markovic, M.: Response of TMJ patients with positive radiographic findings to nonsurgical treatment, *J. Oral Surg.* 34:692-697, 1976.
28. Greene, C. S., and Laskin, D. M.: Symptom status and attitudes of MPD patients following conservative therapy, Abstract #998, in *J. Dent. Res.* 59:518, special issue A, 1980.
29. Roth, R. H.: Functional occlusion for the orthodontist, parts I, II, III, IV, *J. Clin. Orthod.* 15:1981.
30. Chiappone, R. C.: Special considerations for adult orthodontics, *J. Clin. Orthod.* 10:535-545, 1976.

The Angle Orthodontist

Vol. 52, No. 2

A magazine established by the co-workers of Edward H. Angle in his memory . . .

Editor: Raymond C. Thurow
6402 Odana Road
Madison, WI 53719

Business Manager: John S. Kloehn
Zuelke Building
Appleton, WI 54912

Editor Emeritus: Arthur B. Lewis **Assistant Business Manager:** Silas J. Kloehn

Published quarterly by the Angle Orthodontists Research and Education Foundation, Inc.

President: Robert W. Baker

Directors: Nicholas A. DiSalvo

Vice President: John G. Ryan

James J. Baldwin

Secretary: Alton W. Moore

Blaine S. Clements

Treasurer: John S. Kloehn

Walker C. Dorsett

Robert L. Felix
