

*Athletic performance  
related to occlusion*

# Mandibular Repositioning to Enhance Athletic Performance: Is It Well Founded? And More Importantly, Is It Safe?

MARK ROETTGER, D.D.S.\*

Dentistry has a shaded past when it comes to producing objective, scientific data to support clinical modalities.<sup>1</sup> Nowhere is this more evident than in the area of dental kinesiology, or more precisely, mandibular repositioning to enhance athletic performance. Proponents of this elusive concept lack sufficient objective scientific evidence to support their position. This in turn results in an abundance of subjective reports of clinical successes which lack scientific proof of cause and effect. Much of the information in the literature is based on studies that do not fit the criteria for "good science." The well-designed scientific study must be reproducible by other investigators and must use control groups correctly to effectively blind both subjects and examiners, or the results are immediately suspect. Many of the published reports that relate mandibular repositioning and strength are examiner or subject biased, uncontrolled, or anecdotal.

In a recent editorial, Gelb<sup>2</sup> attempted to show that the dental kinesiologists are using better scientific method. However, many questions remain unanswered concerning the safety of mandibular repositioning in contact sports. This will be discussed later

in this paper. First, we should review the beginnings of dental kinesiology.

During the 1950's and 1960's, Stenger<sup>3</sup> reported that certain athletes who wore custom mouthguards noticed improvement in athletic performance, but attempts to explain this phenomenon failed. By the 1970's, it was stated that mandibular repositioning could help the athletic performance of those who experienced "TMJ problems." When anatomy and physiology failed to explain the concept of the mandibular orthopedic repositioning appliance (MORA) and its relationship to body strength, dentistry met chiropractic. It was at this point that applied kinesiology provided a theory as to how enhanced athletic performance could be achieved by mandibular repositioning. Applied kinesiology is a chiropractic field that "concerns the interrelationships between muscles and other parts of the body — those stresses present in one part of the body may affect another part of the body."<sup>3</sup> As explanations were offered, no matter how weak they were, claims surfaced that mandibular repositioning could improve performance in all athletes. Out of these obscure and unfounded beginnings came the athletic MORA.

As interest in the MORA and body strength increased, the concept was put to the scientific test. In 1981,<sup>4</sup> Greenburg conducted a double-blind study and found no statistical difference between placebo splints and repositioning splints. In 1982, Burkett also found no statistical difference between placebo and

\*Dr. Roettger is a member of the Medical Advisory Committee of the Minnesota State High School League, and is a charter member of the Academy for Sports Dentistry. He is in private practice in Stillwater, Minnesota.

*Northwest Dentistry  
Vol. 7/1985*

repositioning splints in upper or lower body strength.<sup>5</sup> A study by Yates in 1984<sup>6</sup> tested the effects of mandibular repositioning on large muscle groups and found no effect on muscle strength. In still another scientific test, Schubert<sup>7</sup> completed a carefully controlled, double-blind study to look at repositioning and strength. Statistical analysis of the data showed that neither upper nor lower body strength was increased with a MORA. Another interesting twist in this study was to provide independent chiropractic applied kinesiology examinations to predict which athletes in the study would benefit most from mandibular repositioning. The group chosen by the kinesiologist failed to show a statistically significant increase in strength. The list goes on. When sound science has been applied to this subject, it has repeatedly failed to stand up as a valid concept.

Studies indicate that the very foundation of mandibular repositioning and strength is suspect, bringing us to the question the entire dental profession should ask: is it safe to reposition the mandible during athletic competition?

Medical science has raised doubt as to the safety and efficacy of mandibular repositioning in the treatment of TMJ disorders. Studies using magnetic resonance (MR) imaging have demonstrated that patients who have been treated for prolonged periods with anterior repositioning splints may present with complications of atrophy, fibrosis, and contracture of the lateral pterygoid muscle.<sup>8</sup> When a muscle is chronically held in a foreshortened condition, there is a permanent shortening of the connective tissue elements in that muscle. Additionally, when any muscle is not allowed to contract against resistance and stretch to its full length, the fibers may suffer disuse atrophy, a progressive loss of myofilaments followed by fibrous re-

placement of collapsed sarcolemmal sheaths.<sup>9,10</sup> This is not to say that wearing an athletic MORA will cause atrophy and/or fibrosis of the masticatory musculature. However, the evidence suggests that before we use these appliances in athletes, especially children, further study is necessary.

Another anatomic consideration concerning the safety of the MORA in contact sports is the posterior attachment (PA) of the temporomandibular joint meniscus. Review of the anatomy and physiology of the PA reveals peculiarities that could discourage the use of the MORA in athletics.

The normal PA consists of loosely arranged collagen fibers, elastic fibers, arteries, an extensive venous plexus, lymphatics, and a generous nerve supply. These structures allow the PA to enlarge during mandibular translation to fill the space vacated by the condyle. Much of this expansion is accomplished by filling of the large venous plexus with blood.<sup>11</sup> Histologic examination of the venous system of the PA reveals large thin-walled veins with many anastomoses. The anatomy and physiology of the PA suggests that the more down and forward the mandible is positioned, the more blood will be drawn into the PA venous plexus. When there is more blood present within the TMJ capsule, there may be potential for more serious injury to the TMJ as a result of mandibular trauma.

A third anatomic factor that is never considered by proponents of mandibular repositioning is the anatomy of the glenoid fossa, especially the articular eminence. The articular eminence forms the anterior superior border of the TMJ. It is convex from anterior to posterior. The incline of the articular eminence differs from individual to individual. Some people have a "steep incline" of the eminence, while others have a "shallow incline." When the mandible is repositioned

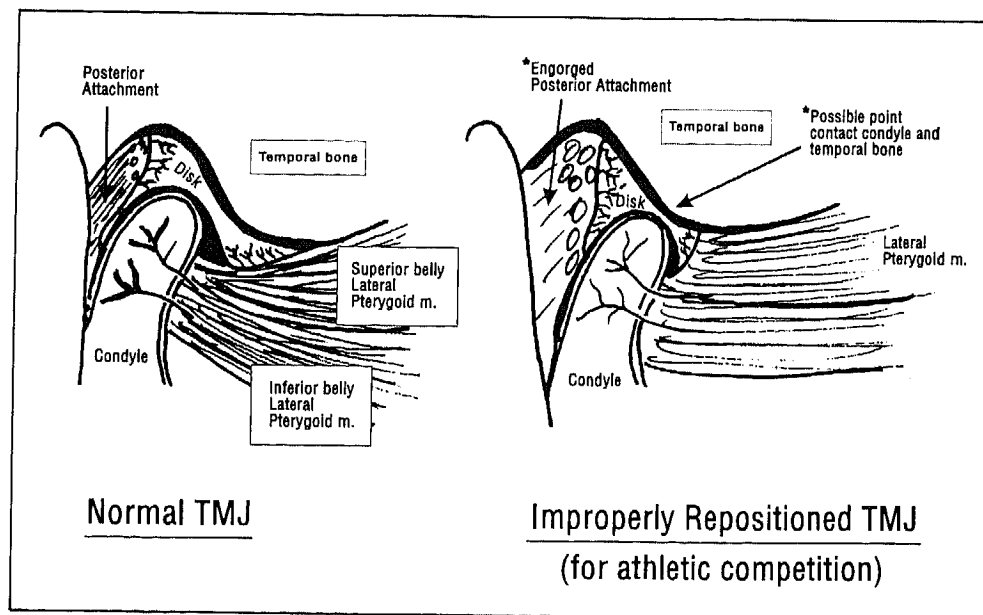


Figure 1.

by a MORA, the convex surface of the mandibular condyle functions against the convex surface of the eminence. This anatomic relationship allows point contact between condyle and eminence (Figure 1), which allows relatively minor trauma to overload the joint at this contact point. This traumatic overload of the joint could potentially result in the development of osteochondritis dissecans (also referred to as osteochondral or transchondral fracture) of the eminence or condyle.<sup>12</sup> The mastoid air cells also often find their way into the articular eminence, and a transchondral fracture with resultant articular surface collapse could produce a communication between the TMJ and the mastoid sinuses.<sup>9</sup>

We can see that there are serious questions as to the safety of repositioning the mandible in the athlete. We have also seen that there has been conflict as to the efficacy of mandibular repositioning to enhance athletic performance. To date, the only studies that have been done in this area consist of stationary strength tests. Relating a stationary strength test to overall athletic performance is a fallacy. Support for this statement comes from mouthguard ventilation studies and exercise physiology. Ventilation studies show that bulkier mouthguards offer more airway resistance and significantly reduce the ability of the athlete to ventilate.<sup>13</sup> Reduction in ventilation results in hypoxia and hypercapnia, logically resulting in decreased performance.

When we look at hockey, football, soccer, basketball, or any sport that requires aerobic metabolism, we begin to appreciate the physiologic problems with the claims that the MORA will enhance athletic performance. A MORA, as originally designed, is inadequate protection for the athlete and should never be used in place of a mouthguard.<sup>14</sup> In order to accomplish repositioning in the athlete, modifications must be made to a mouthguard, either mouth-formed or custom-formed, and these modifications will make the mouthguard more cumbersome. Additionally, repositioning will only occur while the athlete is occluded against the modified mouthguard. Closing into this bulkier mouthguard will decrease the athlete's ability to ventilate. The result of oxygen debt is initiation of anaerobic metabolism, which will increase the amount of lactic acid built up in the muscle tissue. Accumulation of lactic acid will eventually cause fatigue in the very muscles that the MORA is intended to strengthen.

Mandibular repositioning and athletic performance has been a controversial issue for many years. At present there is no credible physiological basis for the existence of such a concept. New understanding of the anatomy and physiology of the TMJ and associated structures suggests there may be serious safety concerns with repositioning the mandible, especially in

contact sports. Exercise and cardiopulmonary physiology show that this concept will not hold up in aerobic sports. With all this negative information, why do we keep hearing about this concept? A likely explanation is that someone has something to gain by exploiting it.

*"The dearth of problem-solving, analytical experiences and interpretation of clinical research literature in dental education ensures the almost complete reliance on opinions of others for an inordinant number of graduates. In many instances, subjective views are provided by individuals or organizations that have a vested interest in the information. The busy dentist, after hearing the same concept repeated despite lack of evidence, eventually accepts the concept as 'fact' and 'standard of care.' In other words, repetition of an idea, even if incorrect, becomes 'truth' in the mind of the recipient, particularly if the ability to critically evaluate the information has never been developed."*

We as a profession must take more responsibility for the protection of our patients by making sure that treatments and devices are safe and effective. It is my hope that responsible dentists will avoid using mandibular repositioning in contact sports until we understand more fully the pathophysiology of TMJ injury. We must not allow entrepreneurs and self-serving individuals to direct our profession, and we must, "above all else, do no harm."

## References

1. Mohl, N.D., and Ohrback, R.: The Dilemma of Scientific Knowledge Versus Clinical Management of Temporomandibular Disorders. *J Prosthet Dent* 67: 113-20, (January) 1992.
2. Gelb, H.: A Too-Polite Silence About Shoddy Science: Dynamic Strength Testing and Beyond. *J Cranio Prac* 10(1): 75-79, (January) 1992.
3. Cited in Jakush, J.: Can Dental Therapy Enhance Athletic Performance? *JADA* 104(3): 292-98, 1982.
4. Greenburg, M.S. et al: Mandibular Position and Upper Body Strength: A Controlled Clinical Trial. *JADA* 103(4): 576-79, 1981.
5. Burkett, L.N. et al: Strength Testing After Repositioning with Mandibular Repositioning Appliance. *Physician and Sportsmedicine* 10(2): 101-7, 1982.
6. Yates, J.W., Koen, T.J., Semenick, D.M., and Kuftevec, M.M.: Effect of MORA on Muscular Strength. *JADA* 108(3): 331-33, (March) 1984.
7. Schubert, M.M. et al: Changes in Shoulder and Leg Strength in Athletes Wearing MORA. *JADA* 108(3): 334-37, (March) 1984.
8. Schellhas, K.P.: MR Imaging of Muscles of Mastication. *AJNR* 10: 829-37, (July/Aug) 1989, and *AJR* 153: 847-55, 1989.
9. Piper, M.: Microscopic Disk Preservation Surgery of the Temporomandibular Joint. *Oral & Max Surg Clin No Am Vol* 1, #2, (December) 1989.
10. *Pathologic Basis of Disease*, by Stanley Robbins. Philadelphia: W.A. Saunders Co., 1974, pages 1420-1478.
11. Scapino, R.: The Posterior Attachment: Its Structure, Function and Appearance in TMJ Imaging Studies. Part I. *J Cranio Dis Facial Oral Pain* 5: 83-95, 1991.
12. Schellhas, K.P.: Temporomandibular Joint Injuries. *Radiol* 173: 211-16, 1989.
13. Hayes, D., Greoras, T., and Maule, J.D.: Effects of Intraoral Mouth Guards on Ventilation. *Physician and Sportsmedicine*: 61-66, (January) 1977.
14. ADA Education Material. Mouth Protectors: Give Your Teeth a Sporting Chance. American Dental Association, 211 East Chicago Avenue, Chicago, Illinois 60611, 1985.