

T.J.'s
B. P. B.
(Bullet Proof Bibliography)
By
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1. Farrar, W.B.: Characteristics of the condylar path in internal derangements of the TMJ. *J. Prosthet. Dent.* 39:319-323, 1978.
2. Weinberg, LA.: Posterior bilateral displacement: Its diagnosis and treatment. *J. Prosthet. Dent.* 34:195, 1975 (Part I). *J. Prosthet. Dent.* 36:426, 1976.
3. Dolwick, M.F.: Normal and abnormal anatomy. In "Internal Derangements of the Temporomandibular Joints." C.A. Helms, R.W. Katzberg, and M.F. Dolich (eds.) Radiological Research and Education Foundation, San Francisco, 1983.
4. Eriksson, L. and Westesson, P.L.: Clinical and radiological study of patients with anterior disk displacement of the TMJ. *Swed. Dent. J.* 7:55-64, 1983.

The above studies noted that internal derangements in the TMJ's result in posterior displacements of the condyles at full occlusion resulting in compression and injury to retrodiscal tissues of the highly innervated bilaminar zone.

5. Scapino, R.P.: Histopathology associated with malposition of the human temporomandibular joint disk. *Oral Surg. Oral Med. Oral Path.* 55:382-397, 1983.

In this study Scapino histologically evaluated 17 TMJ discs that were surgically removed, and described pathological changes in the disc and bilaminar zone due to posterior condylar displacement off the disc.

6. Isberg, A.M. and Isacson, G: Tissue reactions of the temporomandibular joint following retrusive guidance of the mandible. *J. Craniomand. Prac.* 4:143-148, 1988.

In the above study the authors placed composite and cast gold overlays on the teeth of monkeys that resulted in retrusive guidance of the mandible. After only 5 weeks subsequent histological evaluation revealed thinning and flattening of the posterior band of the disc similar to that described in studies done on human discs by Scapino, mentioned above. They also observed that inflammatory

type changes occurred in the bilaminar zone similar to those described by Scapino.

7. Isacson, G., Isberg, A.M. and Persson, A.: Loss of directional control of lower jaw movements in persons with internal derangements of the temporomandibular joint. *Oral Surg. Oral Med. Oral Path.* 66:8-12, 1988.

In this study Isacson studied the loss of conscious motor control of mandibular direction found in patients with internal derangements. 50 patients were instructed to move their mandible laterally to an instructed position. 22 failed to do so properly. Of these 18/22 had proven internal disc displacement that did not reduce. The remaining 4 had internally deranged discs that did reduce. The loss of control was attributed to damaged mechanoreceptors injured by the posteriorly displaced condyles. When anterior condylar repositioning therapy (ART) was performed, proper coordination returned in several of the patients.

8. Graber, T.M.: Temporomandibular joint disturbances and the periodontium. *Int. J. Perio. Rest. Dent.* 6:33, 1984.

In the above publication Dr. T.M. Graber, editor-in-chief of the *American Journal of Orthodontics and Dentofacial Orthopedics*, stated, “the condyle is brought forward in the fossa, and the neuromusculature may adapt to the new position, aided by occlusal interdigitation in habitual maximum contact, a new learned neuromuscular pattern or engram, and the filling in of a compressed retrodiscal pad, when it is no longer traumatized by the condyle.”

9. Anderson, G.C., Schulte, J.K., and Goodkind, R.J.: Comparative study of two treatment methods for internal derangement of the temporomandibular joint. *J. Prothet. Dent.* 53:392-397, 1985.

In this study the authors divided 20 patients with internal derangements into two groups and treated them with either maxillary flat plan splints (stabilization splints) or anterior repositioning splints(ARS). Those receiving ARS experienced a significant reduction in the subjective and objective symptoms of the internal derangements. The patients who were treated with stabilization splints experienced no significant changes in dysfunction level. In fact, two of them worsened to a state of “clinical closed lock”.

10. Lundh, H., Westesson, P.L., Kopp, S., and Tillstrom, B.: Anterior repositioning splints in the treatment of temporomandibular joints with reciprocal clicking. A

comparison with flat occlusal splints and an untreated control group. Oral Surg. Oral Med. Oral Path. 60:131-136, 1985.

In this dramatic study the authors evaluated 70 patients with internal derangements. Patients were divided into the ARS group, the flat plane splint group and the untreated control. Both splint groups had reduced joint tenderness, but the ARS group had greater reduction in joint dysfunction and greater decrease in muscle tenderness!

11. Williamson, E.H. and Sheffield, J.W.: The treatment of internal derangement of the temporomandibular joint: A survey of 300 cases. J. Craniomand. Prac. 5:120-124, 1987.

In the above study the authors evaluated 300 patients with internal derangements treated with anterior repositioning splints (ARS). After symptoms had been eliminated the patients were switched to superior repositioning splints that guided the disc/condyle assembly back to the superior part of the fossa (ie only somewhat decompressed). Those who suffered a relapse were given the choice of reinstating ARS or receiving arthroplasty. 3 to 5 years after completion of treatment, patients were asked to grade themselves on pain, dysfunction and remaining symptoms. Some 270 patients were still pain free. Of the remaining 30 patients 28 were initially pain free while being treated with anterior repositioning therapy (ARS). Their symptoms returned when ARS was discontinued.

12. Lundh, H., Westesson, P.L., Jisander S., and Erikson, L.: Disk- repositioning onlays in the treatment of temporomandibular joint disk displacement: Comparison with a flat occlusal splint and with no treatment. Oral Surg. Oral Med. Oral Path. 66:155-162, 1988.

In the above classic study the authors placed 63 patients with internal derangements into three groups. One group received disc-recapturing cast occlusal onlays. Another group received flat plane occlusal (generic) splints. The third group served as a control. After 6 months the group with the anterior repositioning onlays (which had their mandibles correctly repositioned forward arthrographically) had significantly less pain and dysfunction than the other two groups. No significant difference was noted between the flat plane splint group and the control. Most dramatically, once the onlays were removed all previous symptoms returned within two months in all but one of the forward repositioned patients!

13. Lundh, H. and Westesson, P.L.: Long term follow up after occlusal treatment to correct abnormal temporomandibular joint disk position. Oral Surg. Oral Med. Oral Path. 67:2-10, 1989.

In the above study the authors evaluated 15 patients 1 to 7 years posttreatment. After an initial period of anterior repositioning therapy which had subsequently been “stabilized” by means of either orthodontics or prosthodontics, 11 of the 15 patients were evaluated with corrected sagittal tomography. Nine of the 11 patients had successfully maintained the therapeutic condyle/disc assembly relationship. Of the two who had not, neither were originally repositioned with the aid of arthrography. Yet clinically not one patient had pain either subjectively or upon joint palpation. This shows that some condyles can be allowed to settle or “walk back” as long as it is on to a totally healed joint, (healed by anterior repositioning therapy of sufficient duration.) But it doesn’t always work. In fact more often than not, “walk backs” fail.

14. Okeson, J.P.: Long term treatment of disk interference disorders of the temporomandibular joint with anterior repositioning occlusal splints. J. Prothet. Dent. 60:611-615, 1988.
15. Farrar, W.B. and McCarty, W.L. Jr.: A Clinical Outline of TMJ Diagnosis and Treatment. 9th ed., Normandie Publications. Montgomery, Alabama, 1982.
16. McNeil, C.: The optimum temporomandibular joint condyle position in clinical practice. Int. J. Perio. Rest. Dent. 5:71-72, 1985.

In the above studies it is shown that after successfully eliminating TMJ-headache-pain-dysfunction symptoms with anterior repositioning treatment, only about 25-35% of the patients remained pain-dysfunction free after ARS was stopped and the mandible/condyle was allowed to settle back to it’s original pretreatment occlusal position. Therefore permanent anterior repositioning (relocation) is required. In these circumstances some modicum of “settling back” onto a well healed joint is tolerated. Again, most “walk backs” fail! Therefore, permanent anterior repositioning (relocation) is usually required.

17. Blaustien, D.I. and Scapino, R.P.: Remodeling of the temporomandibular joint disk and posterior attachments in disk displacement specimens in relation to glycosaminoglycans content. Plast. Reconst. Surg. 78:756-764,1986

This important study not only provides histological evidence for pseudo-disc formation after proper, permanent anterior repositioning treatment of TMJ internal derangements, it also proves that patients may be successfully finished “of the disc” in anterior repositioning therapy when disc deformity and/or other factors obviate disc recapture with ARS. Permanent decompression of the posterior joint space and its highly innervated bilaminar zone by forward/downward repositioning (permanently) of the condyle to the “Gelb 4/7 position” is all that is essential for relief of headache and joint pains. Disc recapture is a nicety but not a necessity. Getting the condyle advanced enough to decompress the bilaminar zone and keeping it there permanently in both rest and function, day and night, is a necessity.

18. Williamson, E.H. and Rosenzweig, B.J.: The treatment of temporomandibular disorders through repositioning splint therapy. *J. Craniomand. Prac.* 16:222-225, 1998.

The above study is most important. It settles the TMJ treatment issue once and for all in my mind. A sample of 160 patients treated for a whole host of traditional TMJ headache-pain-dysfunction type signs and symptoms that were a result of posterior condylar displacement, internal derangement type problems were evaluated after anterior repositioning splint therapy. The average time for initial improvement was 22.3 days. The average time for complete remission of symptoms was 4.3 months. Here’s the big one. Of all 160 patients 89.4% experienced complete remission of symptoms and not a single one required surgical intervention!

19. Wexler, G.B., and Steed, P.A.: Psychological factors and temporomandibular outcomes. *J. Craniomand. Prac.* 16:72-77, 1998

This massive study, done by a master’s degree holding TMJ specialist and a clinical psychologist, on 561 patients proves beyond any reasonable doubt that TMJ signs and symptoms are not psychological in origin.

20. Grummons, D.: “Orthodontics for the TMJ/TMD Patient”, Wright and Co. Pub. 7819 E. Greenway Rd., Suite 5, Scottsdale, AZ. 1994.

Additionally, here is an entire 351 page textbook, devoted to the treatment of TMJ problems by means of orthodontics, that is written by an orthodontic specialist, with a number of its chapters written by other prestigious orthodontic specialists the likes of Brendan Stack, R.M. Ricketts, A.H. Owen or other equally respected clinicians, researchers and experts, that says repeatedly that orthodontics is a correct and viable way to correct TMJ headache-pain-

dysfunction internal derangement problems. All toll there are hundreds of further references listed by these various authors that support this concept!

21. Brown, D.T. and Gaudet, E.L.: Temporomandibular disorder treatment: Second report of a large-scale prospective study. *J. Craniomand. Prac.* 20: 244–253, 2000

In this study the authors examined a whopping 2,104 treated, 250 untreated, and 44 long term treated TMD patients using scientifically validated methods, (the TMJ Scale to assure uniform and valid assessment of treated outcomes) and concluded the following, “The use of anterior repositioning appliance therapy produced better results than flat plane splint therapy”.

22. Simmons, H.C. and Gibbs S.J.: Anterior repositioning appliance therapy for TMJ disorders: Specific symptoms relieved and relationship to disk status on MRI. *J. Craniomand. Prac.* 23: 89-99, 2005

This university-based study clearly shows that chronic recurrent headaches are the leading complaint of TMJD patients and 66% of a group of TMJD patients were completely headache free and 33% rated themselves as vastly improved after a course of mandibular anterior repositioning treatment. Some of the headache/TMJ symptoms evaluated in this study were: pain behind the eyes, ear pain, tinnitus, TMJ arthralgia, clicking, joint pain on chewing, and every single patient suffering from their lower jaw locking shut was relieved of that problem i.e. a 100% success rate for that particular clarification of TMJD! The above cadre of symptoms also show that both tension-type headaches as well as the more sinister vascular headaches, or migraines, are part of this scenario, i.e. migraines can be initiated by TMJD!

23. Simmons, H.C.: White Paper: Guidelines for Anterior Repositioning Therapy for the Management of Craniofacial Pain and TMD. *J. Craniomand. Prac.* 23: 300-306, 2005
24. Mintz, S.S.: Craniomandibular dysfunction in children and adolescents: A review. *J. Craniomandibular Prac.* 11:224-231, 1993.
25. Schelhas, K.P., Pollei, S.R., and Wilkes, C.H.: Pediatric internal derangements of the temporomandibular joint: Effect on facial development. *Am. J. Orthod. Dentofacial Orthop.* 104:51-59, 1993
26. Ahn, S.J., Lee, S.P. and Nahm, D.S.: Relationship between temporomandibular joint internal derangement and facial asymmetry in women. *Am. J. Orthod. Dentofacial Orthop.* 128:583-91, 2005.

The above three studies and “White Paper” produced by the AACCP (American Academy of Craniofacial Pain) conspire to produce a devastating cumulative effect. The AACCP “White Paper” firmly attests that ARA (Anterior Repositioning Appliances-and that includes Functional Appliances) are the treatment of choice for TMJD malocclusion-enhanced problems of anteriorly displaced discs that exist in concert with posteriorly displaced condyles, and that ARAs provide the best chance of displaced disc recapture via appropriate permanent mandibular advancement. The AACCP “White Paper” was developed and approved by that organization’s own Board of Directors, a very erudite and prestigious group. The Ahn, Lee and Nahm study (as well as the Schelhas et al study 13 years prior) shows that unilateral condyle-off-disc TMJD problems can lead to facial asymmetries, stunted mandibular growth and shortened ramal height on the affected side. If such occurs unilaterally, a concomitant facial and orthopedic distortion and asymmetry can occur. Not good!

The Mintz study is a survey of the literature from around the world that shows, on average, a minimum of 40% of all children presenting for orthodontic treatment already exhibit varying signs and/or symptoms of TMJD: That’s really not good, (see Ahn, Lee and Nahm above!)

So what this means in the real world is 1.) examine for TMJD, 2.) if you find it, treat it, usually by means of some sort of ARA, and 3.) if it’s in a small child or adolescent, you’d better jump on it, the sooner the better. Facial distortions, unilaterally as Ahn, Lee and Nahm described, or bilaterally as could occur in Skeletal Class II retrusions, are only a harbinger of worse things to come if dysfunctionally induced condyle-off-disc TMJD is left untreated! Ask the chronic migraineurs!

27. Flores-Mir, C., Nebbe, B., Giseon H., and Major P.W.: Longitudinal study of temporomandibular joint disc status and craniofacial growth. *Am. J. Orthod. Dentofacial Orthop.* 130:324-330, 2006

Here’s recent arrival that’s just too important to pass over. In the above article the authors show that when children and/or adolescents suffer from typical “TMJ,” i.e. condyle jammed too far back with its articular disc torn loose and displaced forward, (referred to as “disc” abnormality”), the entire jaw system suffers from diminished and distorted growth of the bones! They concluded, “TMJ disc abnormality was associated with reduced forward growth of the maxillary and mandibular bodies. TMJ disc abnormality was associated with reduced downward growth of the mandibular ramus.” So what this means is that not only does the lower jaw growth become distorted when a child or adolescent suffers from “TMJ” as 40% of them do (at least the ones that need braces, see “Mintz” study above), but now it’s even shown that the upper jaw (maxilla)

suffers from reduced (distorted, improper) growth also! Can the noose get any tighter?

28. Cooper, B.C., Kleinberg I.: Relationship of temporomandibular disorders to muscle Tension-type headaches and a neuromuscular orthosis approach to treatment. CRANIO. 27:101-107, 2009

And to all this, add this even more recent arrival. This study shows the extensive literature (and its own clinical research evidence) that definitively supports the TMJ/T-type/Migraine continuum! This study was performed, in conjunction with an extensive review of the literature, to determine whether there is significant evidence to support a relationship between headache and TMD prevalence. The authors state, “In the literature there was a substantial amount of evidence for a positive relationship between TMD and the prevalence of headaches and most importantly, that these were the muscle-tension type. The evidence for a cause and effect relationship was strong.” The authors stated further, “The benefits of resolving headaches at an early stage in their development is that it might result in the reduction of its potential for progression to a chronic and possibly migraine headache condition,” alluding to the aforementioned TMD/T-type/migraine headache continuum elucidated by other notable headache researchers.

Yet in spite of all this, there are still those individuals who deny that the Ortho/TMJ/T-type/Migraine headache connection exists at all, and who continue to claim that there is no support for it “in the literature”! As the Italian astronomer Galileo Galilei once said, “It would not be enough even if the stars came down to earth to bring witness about themselves”. (Reply to a letter from one of his students, Fr. Benedetto Castelli, concerning the rejection of certain of Galileo’s astronomical discoveries by the hierarchy of the Church.)