ANNOTATED BIBLIOGRAPHY IN SUPPORT OF BioRESEARCH MASTICATION ANALYSIS

Kuwahara T, Bessette RW, Maruyama T
Effect of continuous passive motion on the results of TMJ meniscectomy. Part I: Comparison of chewing movement.
Cranio 1996 Jul;14(3):190-199

In order to evaluate the therapeutic effect of continuous passive motion (CPM) on the outcome of TMJ meniscectomy, chewing movement was analyzed before surgery and six months after surgery in 31 patients receiving CPM (CPM group), 26 patients without CPM (non-CPM group), and in ten normal subjects. The surgical procedure consisted of either total meniscectomy or partial meniscectomy with disk repair. It was found that chewing in patients receiving CPM was closer to the normal range than for patients in the non-CPM group. The results from the CPM group demonstrated chewing parameters for patients with partial meniscectomy returning to the normal range. However, for the patients with total meniscectomy, some parameters remained out of the normal range. From these results, we conclude that CPM has a positive influence on the outcome of TMJ surgery.

Kuwahara T, Bessette RW, Maruyama T
The influence of postoperative treatment on the results of TMJ meniscectomy. Part II: comparison of chewing movement.
Cranio 1996 Apr;14(2):121-131

In order to evaluate the influence of different types of postoperative treatments on the results of TMJ surgery, chewing movement recorded postoperatively was compared in 32 patients with unilateral total meniscectomy, 42 patients with partial meniscectomy with disk repair, and 10 normal subjects. Postoperative treatment was of three different types depending on its strategy. It was found that postoperative treatment had a significant positive effect on the results of both total and partial meniscectomy. Postoperative treatment which included both physical medicine modalities and dental treatment demonstrated better results than only dental treatment or no postoperative treatment. However, none of these studied techniques could recover chewing movement to the normal range.

Kuwahara T, Bessette RW, Maruyama T
Characteristic chewing parameters for specific types of temporomandibular joint internal derangements.

Cranio 1996 Jan;14(1):12-22

In order to determine if there are characteristic chewing patterns for specific types of TMJ internal derangements, chewing was analyzed in 210 TMD patients with unilateral internal derangement (MDR early, 40; MDR late, 41; MD, 80; MDP, 49), and in 94 TMD patients without internal derangement, and 10 asymptomatic subjects with normal TMJ imaging. Each internal derangement subgroup demonstrated a significantly restricted envelope of motion and a reduced chewing velocity especially when they chewed on their normal TMJ side. Comparing different types of internal derangement, the MDR early group demonstrated relatively normal chewing, while the MDR late, MD and MDP groups showed severely impaired chewing movements. Among these three groups, the MD group demonstrated the most impairment, followed by the MDP and the MDR late groups. These results demonstrate that different types of internal derangement have specific impairments upon chewing, suggesting use of this analysis as a diagnostic tool.

Kuwahara T, Bessette RW, Maruyama T
Chewing pattern analysis in TMD patients with unilateral and bilateral internal derangement.
Cranio 1995 Jul;13(3):167-172

In order to evaluate chewing in temporomandibular disorder (TMD) patients with unilateral and bilateral internal derangement of the temporomandibular joint (TMJ), the envelope of motion and velocity of chewing were analyzed in 103 TMD patients with unilateral internal derangement, 42 patients with bilateral internal derangement and 10 normal subjects. It was found that patients with bilateral internal derangement demonstrated a significantly restricted range of motion and reduced velocity than patients with unilateral internal derangement or normal subjects. The analysis of chewing patterns in the frontal and sagittal planes revealed that patients with bilateral internal derangement had no specific pattern while patients with unilateral internal derangement demonstrated a specific pattern. The analysis of chewing velocity pattern suggested that opening and closing patterns without any obvious peak velocity was significantly more frequent in patients with bilateral internal derangement than patients with unilateral internal derangement or normal subjects.

Kuwahara T, Bessette RW, Maruyama T
Chewing pattern analysis in TMD patients with and without internal derangement: Part II.
Cranio 1995 Apr;13(2):93-98

In order to investigate the chewing movement of temporomandibular disorders (TMD) patients with and without internal derangement of the

temporomandibular joint (TMJ), the velocity of chewing movement was analyzed in 103 TMD patients with unilateral internal derangement (D group), 94 TMD patients without internal derangement (NID group) and 10 normal subjects (normal group). The ID group showed a significantly reduced maximum opening velocity, a significantly smaller standard deviation for the velocity and a significantly frequent opening velocity pattern with a deceleration in the middle of opening compared to the NID or the normal groups. The NID group demonstrated significantly frequent opening velocity patterns without any velocity peak compared to the ID or normal groups.

Kuwahara T, Bessette RW, Maruyama T
Chewing pattern analysis in TMD patients with and without internal derangement: Part I.
Cranio 1995 Jan;13(1):8-14

In order to investigate the chewing movement of temporomandibular disorders (TMD) patients with and without internal derangement of the temporomandibular joint (TMJ), analysis of the envelope of motion during chewing was performed in 103 TMD patients with unilateral internal derangement (ID group), 94 TMD patients without internal derangement (NID group) and 10 normal subjects (normal group). The analysis of numeric parameters revealed that the ID group demonstrated a significantly restricted range of motion compared to the NID or normal groups, and the NID group demonstrated significant irregularity of chewing compared to the ID or normal groups. The analysis of chewing also demonstrated that the chewing pattern for the ID group demonstrated more frequent deviation of the turning point to the nonchewing side in the frontal plane and a narrow anteroposterior pattern in the sagittal plane compared to the other groups. No characteristic chewing patterns were identified for the NID group.

Kuwahara T, Bessette RW, Maruyama T
The influence of postoperative treatment on the results of temporomandibular joint menisectomy. Part I: Comparison of mandibular opening and closing movements.
Cranio 1994 Oct;12(4):252-258

In order to evaluate the influence of postoperative treatment on the results of temporomandibular joint (TMJ) menisectomy, the maximum voluntary opening and closing movements of 67 patients who underwent either total menisectomy or partial menisectomy with disk repair were analyzed and compared to those of 10 normal subjects. The postoperative treatment was classified into three different types depending on its strategy. It was observed that

postoperative treatment which emphasized physical medicine modalities could produce opening and closing movements of the mandible closer to the normal range. The effect of the postoperative treatment on the results of total menisectomy was more significant than that on the results of partial menisectomy with disk repair. Partial menisectomy with disk repair resulted in better opening and closing movement than total menisectomy.

Ishigaki S, Bessette RW, Maruyama T
Diagnostic accuracy of TMJ vibration analysis for internal derangement and/or degenerative joint disease.
Cranio 1994 Oct;12(4):241-245

Lower joint arthrography and videofluoroscopy were used to diagnose 297 joints from temporomandibular disorders (TMD) patients. The surface vibrations of the temporomandibular joints (TMJs) were recorded by electrovibratography and a parameter set was derived through frequency analysis. Total vibration energies were used as the primary separating threshold for abnormal joints. The following conditions were statistically discriminated by multi-variate analyses: I) meniscal displacement with reduction; II) meniscal displacement with a partial disk reduction; III) meniscal displacement without reduction; and IV) degenerative joint disease and/or perforation of the disk. Using the total vibration energy as a threshold, the diagnostic sensitivity for the abnormal joints was 82%, while the diagnostic specificity for the joints with no evidence of internal derangement was 75%. Discriminant analysis for the above-mentioned four conditions revealed a diagnostic sensitivity of 79.0%, 85.7%, 77.1% and 76.3% for conditions I, II, III and IV, respectively. The diagnostic specificity was 76.2%, 79.9%, 59.0% and 77.9% for conditions I, II, III and IV, respectively. It was concluded that vibration analysis of the TMJ could be clinically useful as a screening examination for TMD patients.

Kuwahara T, Bessette RW, Maruyama T
A retrospective study on the clinical results of temporomandibular joint surgery.
Cranio 1994 Jul;12(3):179-183

A retrospective study on the results of temporomandibular joint (TMJ) surgery was performed in 74 patients with total menisectomy, 90 patients with partial menisectomy with disk repair, and 66 patients with arthroscopic lysis of adhesion and lavage of the joint space. TMJ pain during jaw movement, TMJ noise and maximum jaw opening was evaluated one year after surgery. TMJ pain and TMJ noise were significantly reduced by all three procedures. However, TMJ clicking was more significantly observed in patients with arthroscopy. Maximum jaw opening was significantly increased by all three

procedures. However, maximum opening of patients with total menisectomy was significantly smaller than in the other two procedures.

Ishigaki S, Bessette RW, Maruyama T
Vibration analysis of the temporomandibular joints with degenerative joint disease.
Cranio 1993 Oct;11(4):276-283

The surface vibrations of 42 temporomandibular joints (TMJ) with degenerative joint disease (DJD) and/or perforation of the disk were evaluated using electrovibratography and compared to the surface vibrations of 83 joints with normal TMJ imagings and 61 joints with meniscal displacement without reduction. Through the frequency spectrum analysis, TMJs with DJD showed higher vibration energy above 350-450 Hz and TMJs with perforation showed higher vibration energy between 100-150 and 300-450 Hz. The presence of perforation did not seem to affect the characteristic of vibrations when TMJs were associated with DJD. A threshold was set for the total vibration energy as described in our previous report and used as a parameter in order to separate patients with internal derangement from a pool of TMJ dysfunction patients (diagnostic specificity = 75%, diagnostic sensitivity = 80.2%). Using this criteria, the following were correctly identified as internal derangement and/or DJD: a) 100% of the TMJs with meniscal displacement without reduction associated with DJD; b) 87.0% of the TMJs with meniscal displacement without reduction associated with perforation; c) 88.9% of the TMJs with meniscal displacement without reduction associated with DJD and perforation; and d) 100% of the TMJs with perforation.

Ishigaki S, Bessette RW, Maruyama T
Vibration analysis of the temporomandibular joints with meniscal displacement with and without reduction.
Cranio 1993 Jul;11(3):192-201

The vibrations of 102 joints demonstrating meniscal displacement with either early or late reduction (MDR-early/MDR-late) and 70 joints displaying meniscal displacement without reduction either incomplete or complete (MD-incomplete/MD-complete) were analyzed and compared to 83 arthrographically normal but symptomatic joints (NID) using electrovibratography (EVG). The total power density of the vibration [I(T)], peak power density [I(max)] and power density at each 50Hz range between O to 600 Hz [I(f)] showed the highest in the MDR-late group followed by the MDR-early group, suggesting that the level of vibration is related to the degree of disk displacement and reduction. The wave characteristic parameters such as the correlation coefficients between I(T) and each I(f) showed higher correlation at higher frequency ranges as the degree of disk displacement progressed, from MDR-early to MDR-late to MD-incomplete. The diagnostic sensitivity of EVG when using I(T) as a determining parameter was 96.6% for

the MDR-early group, 91.8% for the MDR-late group, 77.8% for the MD-incomplete group and 57.4% for the MD-complete group with the specificity for the NID group at 75%.

Ishigaki S, Bessette RW, Maruyama T
Vibration of the temporomandibular joints with normal radiographic imagings: comparison between asymptomatic volunteers and symptomatic patients.
Cranio 1993 Apr;11(2):88-94

In order to estimate the effect of a background noise during temporomandibular joint (TMJ) vibration analysis, 40 recordings from sensors not attached to subjects and sensors attached to subjects without any jaw movement were evaluated. Both of them showed very small energy density, close to 0, throughout 0 to 600 Hz and flat frequency distributions. To evaluate the vibration energy of asymptomatic TMJs with normal joint anatomy and symptomatic TMJs with normal arthrographic imagings, 20 TMJs from 10 clinically normal and asymptomatic volunteers with bilateral normal TMJ computerized tomography (CT) scanning (N-control) were analyzed at four mandibular positions. Results from intercuspal position and maximal opening were identical to the background noise. Results from closing and opening phase showed higher energy, especially below 150 Hz, than the background noise. Surface vibrations of 83 TMJs from patients with arthrographically normal imagings but having symptoms (NID) showed significantly higher energy than the N-control group above 300 Hz. When the total vibration energy (I(T)) is used to set the threshold for the separation of internal derangement, at I(T) = 2.06, the diagnostic specificity for the NID group is 75%, while the diagnostic sensitivity is 82.4% for internal derangement. At the same time, 98.3% of the N-control group was involved below the threshold.

Ishigaki S, Bessette RW, Maruyama T
A clinical study of temporomandibular joint (TMJ) vibrations in TMJ dysfunction patients.
Cranio 1993 Jan;11(1):7-13

Using electrovibratography (EVG), the vibrations of 309 temporomandibular joints (TMJs) from 213 patients with clinical symptoms of temporomandibular joint dysfunction (TMD) were compared to TMJ arthrography. Of 309 imaged joints, 221 had an internal derangement (ID) and 88 were arthrographically normal (NID). Among the parameters derived from the power spectrum function of joint vibration, the total power density from 0 to 600 Hz (I(T)), the peak power density I(max)), and the power density at each 50 Hz frequency range (I(f)), each of these was significantly greater in ID than in NID patients. The frequency range that included (I(max) and the frequency range containing 50%, 75%, and 90% of I(T) was significantly lower in ID than in NID patients. The diagnostic sensitivity and specificity of a patient's perception of TMJ

sounds were 43% and 80%, respectively, while those for a doctor's perception were 54% and 72%. When using I(T) as a parameter, the sensitivity and specificity of the EVG were 75% and 77%, respectively. By using these parameters of TMJ vibration energy analysis, a separation may be made between patients with normal joint anatomy and internal derangement.

Ishigaki S, Bessette RW, Maruyama T
The distribution of internal derangement in patients with temporomandibular joint dysfunction--prevalence, diagnosis, and treatments.
Cranio 1992 Oct;10(4):289-296

This study consisted of 355 patients referred to a surgical practice complaining of facial pain, temporomandibular joint (TMJ) sounds, and limited jaw opening. In 247 patients, 360 TMJs were evaluated by arthrography. While 72.2% of them had internal derangement, the remaining 27.8% had normal arthrograms (NID). Among the patients with internal derangement, meniscal displacement with reduction (MDR) was the largest group (47.3%), followed by meniscal displacement without reduction (MD) (32.3%), meniscal displacement without reduction associated with perforation (MDP) (15.4%), and perforation with normal disk position (P) (5.0%). The NID, MDR, and MD groups showed similar age distributions. The MDP and P groups showed a significantly older mean age. Gender distribution was biased toward females (82.0%). Of the total number of joints, 183 (50.8%) had a history of trauma, 69.9% of which had an internal derangement. In terms of treatment, 100% of the NID group was treated by splint therapy. The MDR group was mostly treated by partial meniscectomy (49.6%) and splint therapy (41.5%). The MD group was mostly treated by total meniscectomy (53.6%) followed by splint therapy (32.1%). The MDP or P groups mostly underwent total meniscectomy (72.5% and 61.5%, respectively).