

## Orthopedic Regulator Mouthpiece— A Case Report

By Douglas Chase, DDS, FICCMO

Cranialmandibular cervical disorders (CMCD) deals with a wide variety of pathology resulting from human actions. Sports, travel, work, and hobbies carry various risks of anatomical and physiological stress triggering pain or dysfunction. Some of these risks happen quickly and some slowly over long periods of time. This article will look at a case of Temporal Mandibular Joint (TMJ) damage triggered by a regulator mouthpiece used in scuba diving.

The TMJ is an encapsulated space where the skull and the lower jaw (mandible) join in a ball and socket shaped area. The joints are located on the side aspect of the skull bilaterally. The lower jaw is held in place with various ligaments and has a fibrocartilaginous disk between the two bony surfaces (see fig.1). The disk allows for gliding and rotation of the jaw during function.

Over time these joints can sustain damage from conditions such as poor child facial development, trauma from accidents, jaw re-posturing for breathing problems, changes in the bite (tooth loss or dental treatment), habits such as cheek-biting or grinding/clenching of the teeth, and orthodontics changing jaw posture. These are examples of situations that can place a load on the disk and joint causing the body to adapt and compensate.

As long as the body can adapt and compensate, the individual notices no pain or dysfunction. However, with the accumulation of damage, at some point a triggering event can change the equilibrium, and the person will notice the start of pain or dysfunction. The use of a regulator mouthpiece can be such a trigger since it puts a great deal of

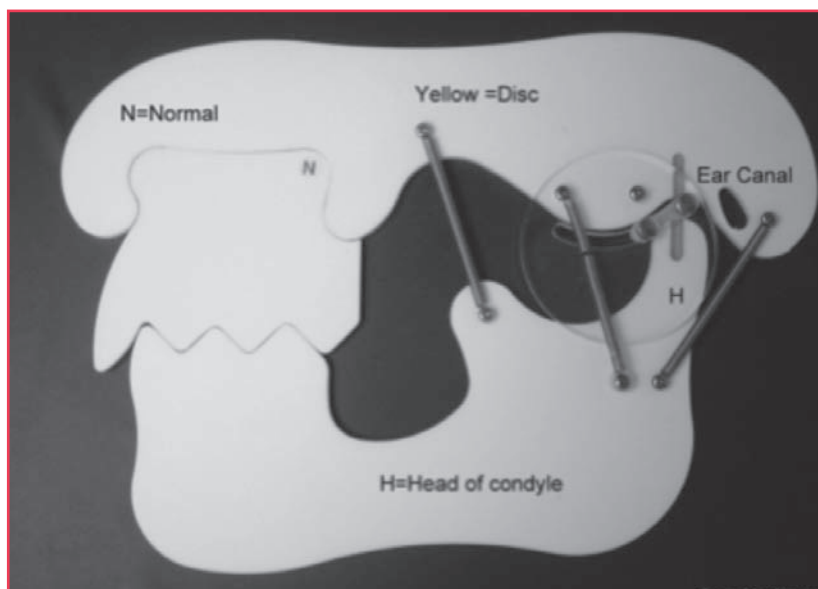


Fig. 1 Normal TMJ

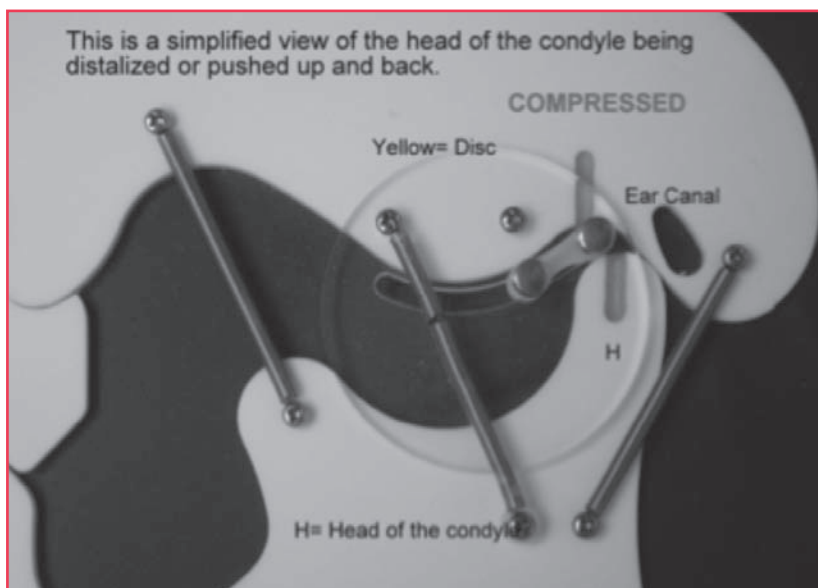


Fig. 2 Compressed TMJ

isometric force into the joint space. These forces also introduce different biting angles and can introduce different configurations of forces that the TMJ has to adapt to. Signs the jaw cannot handle the forces from the

gripping action of a mouthpiece by the diver can include: TMJ/ear pain, TMJ clicking, reduced TMJ mobility, headache and facial pain, chewing pain, vertigo, ringing in the ears, and ear congestion. The worst-case

scenario has the disk between the two bones pushed out with dislocation as a result (see fig.2). Pain and limited jaw function result.

Over the years various regulator mouthpiece configurations and materials have been tried. What is missing from these designs is knowledge of the physiological posture that is correct for a particular person. Currently, there are a number of dental care providers that have equipment that can both find the physiological position the jaw should assume passively in 3D and can confirm muscle neutrality, which provides comfort to the individual. The following is a case where a regulator mouthpiece triggered TMJ pain and dysfunction for a diver.

A dive instructor presented with limited jaw opening, pain with chewing, headaches, and severe pain when holding a regulator mouthpiece in position. The individual had a history of jaw popping but never any pain. The differential workup resulted in a diagnosis of TMJ disk dislocation without recapture (stuck in front). Due to the patient's young age and relatively recent symptoms it was hoped some recapture of the disk could be gained with treatment. The goal was to find the physiological jaw position that would provide the best functional jaw muscle position and least damaging position for the joints and disks. With use of bioinstrumentation (myotronics K7) and employing neuromuscular principles; anatomical and functional data on jaw posture, jaw movements, electromyography (EMG) of rest/function, and other biometric parameters were recorded.

With information showing in 3D on a computer screen a bite registration of the six planes of occlusion (vertical, anterior/posterior, lateral, pitch, yaw, roll) between the two jaws was obtained in a stiff putty (Fig. 3).

From this registration a functional orthotic was to be created. After the bite was taken, a "blank" custom regulator mouthpiece for

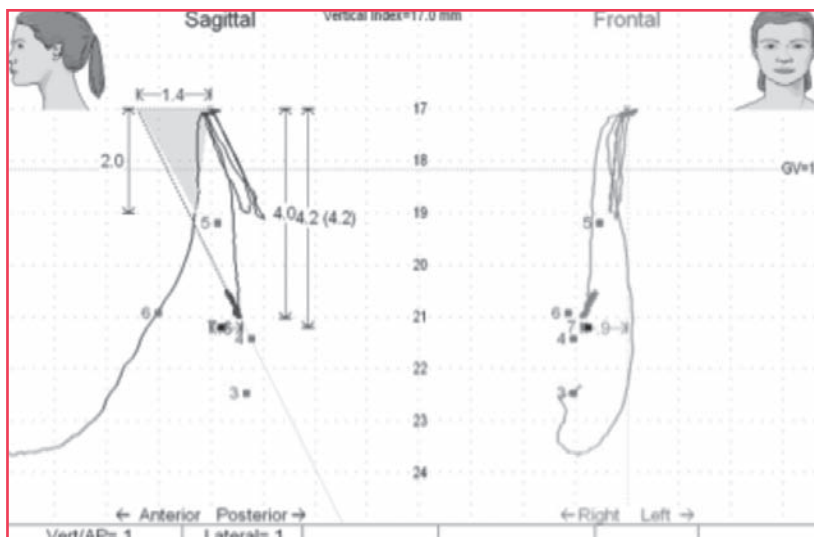


Fig. 3 Old and new jaw posture

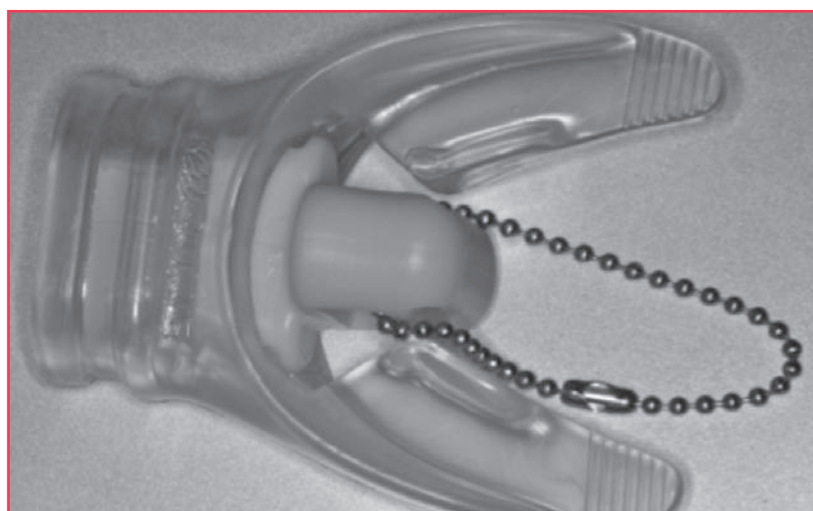


Fig. 4 Mouthpiece "blank"



Fig. 5 Corrected myocentric bite



scuba diving was taken and heated per directions (Fig 4.). It was placed into the mouth and again the patient was guided into the same “myocentric” position as shown with the taking of the putty bite (Fig.5).

A functional day/night orthotic provided a “new” physiologically correct position for the jaw to assume. After 30 hours of wear the patient’s headaches subsided, and pain with chewing was reduced. Over the course of seven days her range of motion improved and she could chew “most” foods without pain.

The patient’s real excitement was that she could scuba dive with relative comfort by using the customized mouthpiece that was also created at the time. The disks were not recaptured fully due to anatomical damage; however the patient could go extended timeframes holding onto the myocentric scuba diving regulator mouthpiece.

It should be noted that a “boil and bite” mouthpiece you do at home will often not make it physiological. It will be “custom” but to your habitual bite path. In this author’s opinion, most often this is the path that contributes to the problem in the first place. In this case the patient did try to create a “custom” mouthpiece at home. It made the pain worse with placement, which is consistent with the concept that if the habitual bite is incorrect then clenching into a plastic form of the same path will provide additional pathological pressure to the joints.

CMCD is a complex set of problems we may face. Individuals in particular sports will even give names to sport specific pathology such as “diver mouth syndrome.” The human masticatory musculature is not designed to cope with extended periods of isometric contraction such as required to retain a regulator mouthpiece. It is not the conclusion of this article that regulator mouthpieces “cause” TMJ pathology but that they contribute to it and in cases may trigger acute episodes. Dentistry has debated many of the factors that change a person’s condition of

adaptation to that of pain in the TMJ region. Theories are controversial. Technology and research is changing what is known about the TMJ, its function, and mechanisms of dysfunction. A neuromuscular myocentric position is an advanced current method to help alleviate pain and dysfunction through understanding and knowledge of what the studied muscles are doing at any point in function or rest with the mandible (lower jaw). With information of the mandible’s position a dentist can develop orthotics or in this case a regulator mouthpiece that maintains neutral physiological position that is healthy for the TMJ and affected muscles

The sport of diving is widespread and most participants adapt to various anatomical and physiological loads the body has to deal with during dives without pain or dysfunction. However, there are many papers relating scuba mouthpieces to TMJ and more globally to CMCD issues. This article describes one solution that would be more predictable in outcome and provide a reinforcement of a physiological neutral position of the jaw. The position acquired through bioinstrumentation actually encouraged a position that is more anatomically sound than their habitual bite.

Scuba divers should be aware of symptoms that the jaw joint is not in ideal health. Symptoms indicate loads on the TMJ are beyond compensation capabilities. There are new techniques available to provide physiological positions that can help with acute distress of the TMJ and encourage additional adaptation of the TMJ complex. It is the hope of this author that additional interest will be generated by manufacturers of mouthpieces to work in conjunction with dentists familiar with bioinstrumentation and provide physiologically accurate custom mouthpieces for those that can no longer adapt well to the stress required of the sport.

Scuba diving is a physically demanding sport with rewards of the beauty to see and interacting with nature on a personal level.

The connection to this world requires air to breathe. Connecting man-made equipment to a biological organism is challenging. Continued advances in technology and an appreciation of the anatomical forces required will lead to an even greater enjoyment of being a part of this watery world.

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