

TEMPOROMANDIBULAR DISORDERS IN SCUBA DIVERS DURING DIVING CERTIFICATION  
TRAINING PROGRAMME

*DALIŞ SERTİFİKASYONU EĞİTİM PROGRAMINDA SCUBA DALICILARINDA GÖRÜLEN  
TEMPOROMANDİBULER BOZUKLUKLAR*

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**ABSTRACT**

**Objective:** The design of a diving regulator's mouth-piece is known to increase the risk of a temporomandibular disorder (TMD) in SCUBA divers. The total weight of a diving regulator is reflected directly on the temporomandibular joint (TMJ) causing articular and periarticular problems. In this study, the prevalence of TMD in SCUBA divers having a training for diving certification is investigated. We also aimed to determine the factors that lead to TMD, and clarify the observation that there is an increased incidence of TMD in inexperienced divers with an anxiety of diving training.

**Material and methods:** The study was held in a period of 5.5 years, between 2006 and 2011. Ninety-seven divers were referred with the complaint of pain around the temporomandibular area. The divers were classified according to their experience levels. Symptoms and signs of TMD were noted and graded.

**Results:** 14 divers were diagnosed with TMD. It was found that TMD was seen more frequently in inexperienced divers than in experienced divers (p=0.0434). The most prevalent symptom was an increased effort spent for holding the mouth-piece during a dive. TMJ tenderness and trigger point activation were the mostly seen physical signs. 13 divers had an improvement with therapy.

**Conclusion:** The effort for stabilizing the mouth-piece of the second stage of a diving regulator is a recognized factor in TMD development. The training for diving certification causes an increase in the prevalence of TMD.

**Key words:** Temporomandibular joint, Temporomandibular disorder, Myofascial pain, SCUBA, diving, diving regulator, mouth-piece

**ÖZET**

**Amaç:** Bir dalış regülatöründe ağızlık dizaynının SCUBA dalıcılarında temporomandibuler bozukluk (TMB) riskini arttırdığı bilinmektedir. Dalış regülatörünün tüm ağırlığı artiküler ve periartiküler problemlere sebep olacak şekilde temporomandibuler eklem (TME) üzerine yansımaktadır. Çalışmamızda, dalış sertifikası eğitimi alan SCUBA dalıcılarında TMB prevalansını araştırdık. Aynı zamanda, TMB'ye yol açan faktörleri belirlemek ve dalış eğitimine bağlı anksiyetenin belirginleştiği tecrübesiz dalıcılarda TMB'nin daha sık görüldüğüne dair gözlemi aydınlatmayı amaçladık.

**Gereç ve yöntem:** Çalışmamız, 2006 ve 2011 arasındaki 5,5 yıllık bir süre içinde gerçekleştirildi. 97 dalıcı temporomandibuler alan etrafında belirginleşen ağrı şikayeti ile refere edildiler. Dalıcılar tecrübe seviyelerine göre sınıflandırıldılar. TMB'ye ait belirti ve bulgular belirlendi ve sınıflandırıldı.

**Bulgular:** 14 dalıcıda TMB teşhis edildi. TMB'nun tecrübesiz dalıcılarda tecrübelilerden daha sık görüldüğü saptandı (p=0.0434). En sık görülen belirti dalışta ağızlığı tutma eforunun artması olarak saptandı. TME hassasiyeti ve tetik nokta aktivasyonu en sık görülen bulgular olarak saptandılar. 13 dalıcıda tedavi ile iyileşme sağlandı.

**Sonuç:** Dalış regülatörünün ikinci kademesinin ağızlığını sabitleme eforu TMB gelişiminde bilinen bir faktördür. Dalış sertifikasyonu eğitiminde artan anksiyete TMB prevalansında artışa neden olmaktadır.

**Anahtar kelimeler:** Temporomandibuler eklem, Temporomandibuler bozukluk, Miyofasyal ağrı, SCUBA, dalış

**INTRODUCTION**

Diving with "Self-contained Underwater Breathing Apparatus" (SCUBA) is one of the leading recreational sports with an increasing number of performers (3). In the last decade, scientific investigations in the field of recreational and professional SCUBA diving focused on improving the technology of diving equipment with the aim of increasing underwater comfort and exercise capacity of divers and maintaining a simultaneous

decrease in the subaquatic health problems associated with the technical insufficiencies of SCUBA (8).

A diving regulator is one of the most important components of SCUBA hardware. Despite prominent advancements in the technology of a regulator, the design of a regulator's mouth-piece has a long-standing standard which is recognized as a factor in increasing the risk of a temporomandibular disorder (TMD) in SCUBA divers (1,8,14).

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A diving regulator controls the pressure of air supplied to the diver and a typical regulator consists mainly of two stages (air calibrating stations) (Figure 1). The first stage of the regulator is stabilized on top of the diving tank and reduces the pressurised air of the diving tank to an intermediate pressure. Compressed air flows from the first stage to the second stage through a flexible low-pressure hose. The second stage of a regulator consists of a demand valve combined with a mouth-piece. After equalizing air to the ambient hydrostatic pressure, the demand valve of the second stage, held in the mouth of the diver with the assistance of a mouth-piece, serves air to the respiratory tract through an airway passage in the mouth-piece. The mouth-piece is gripped between the upper and lower teeth by compression. The vestibular shield of the mouth-piece is dimensioned to extend laterally into the buccal vestibule and vertically to overlap the gums (Figure 2). While lips surrounding the vestibular shield of the mouth-piece create an air and water tight seal, palatal flange and interdental bite platforms reinforce the stability of the mouth-piece (Figure 2). Second stage is also used to exhale air.

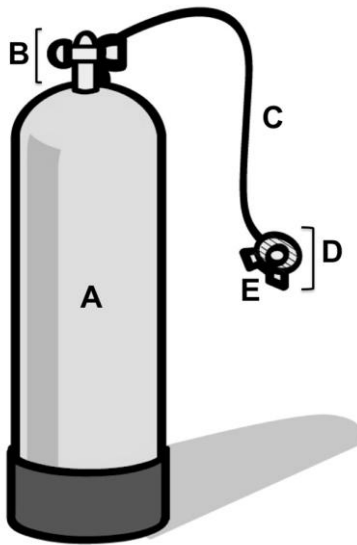


Figure 1. Diving tank and the regulator are the most important components of SCUBA equipment (A, diving tank; B, first stage of the regulator; C, flexible low-pressure hose; D, second stage of the regulator; E, mouth piece)

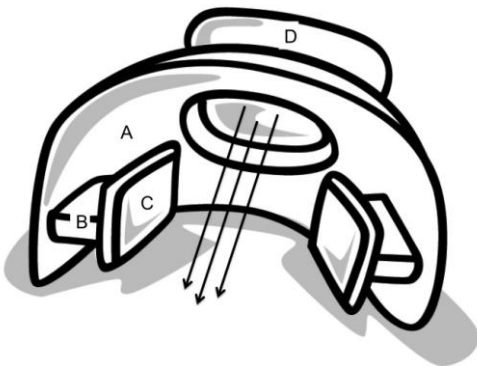


Figure 2. Mouth-piece of the second stage (A, vestibular shield; B, interdental bite platform; C, palatal flange; D, connector tube to the demand valve of the second stage; arrows, air passing through the passage from the demand valve of the second stage to the respiratory tract of the diver).

The total weight of a regulator's second stage and the low-pressure hose is reflected directly on the temporomandibular joint (TMJ) and the mandibular musculature with over-exertion (1,8,14). Articular and periarticular problems of the TMJ have been detected due to the strong compression force spent by upper and lower jaws for stabilizing the mouth-piece and carry the second stage of the regulator (1,2,8,14). While the conventional design of a mouth-piece is known to play a role in increasing the tendency of damage in TMJs due to an imbalance of load during occlusion, myofascial pain is a routine complaint enunciated by many SCUBA divers.

Although SCUBA divers attended by an otolaryngologist with the complaint of temporomandibular pain are initially suspected of having an otic barotrauma, otitis externa or a barodontalgia, a TMD has to be evaluated as a probable diagnosis. In this study, the prevalence of TMD in SCUBA divers having a training programme for diving certification is investigated. We also aimed to determine the related factors that lead to TMD during SCUBA training and clarify the observation that there is an increased incidence of TMD in inexperienced divers with an anxiety of diving training.

### MATERIAL AND METHODS

A prospective study was conducted to determine the prevalence of TMD in SCUBA divers who were having a training for SCUBA diving certification. The study was held in a period of 5.5 years (approximately 6 diving seasons), between April 2006 and November 2011.

The divers having a previous diagnosis of TMD, degenerative arthritis, trigeminal and postherpetic neuralgias, dental infections, episodic vascular type headaches, and a history of a previous operation of the temporomandibular area and mandibula were excluded from the study. The divers using the conventional regulators and mouth-pieces (with no trade names) provided by the technical department of the diving club were included into the study.

The registered SCUBA trainees of the "Turkish Divers Club (Türk Balıkadamlar Kulübü, TBK), Istanbul" attended the study. The diving club conducted SCUBA certification training programs and performed routine trips in the Marmara, Aegean and Medittarenean seas, and the sample of patients came from the educational activities in the club pool and the diving points of the above mentioned locations.

In Turkey, diving certification for recreational SCUBA is issued by "Confédération Mondiale des Activités Subaquatiques" (CMAS) organization in association with "Turkish Underwater Sports Federation (Türkiye Sualtı Sporları Federasyonu)". CMAS has a star system for grading and certifying the divers according to the experience level, i.e., CMAS 1 star (CMAS\*), CMAS 2 star (CMAS\*\*), and CMAS 3 star (CMAS\*\*\*). A beginner attends a CMAS\* course. If a CMAS\* diver performs 20 open sea dives, the diver can attend a CMAS\*\* course; and for becoming a dive leader, divers having a CMAS\*\* certificate can attend a CMAS\*\*\* course after performing a minimum of 40 open sea dives.

In Turkey, a diving season usually starts in the middle of April and terminates at the end of November, and a total of 9 diving certification courses (6 CMAS\*, 2 CMAS\*\*, and 1 CMAS\*\*\*) are programmed in TBK during this period. Each diving course consists of a 3-week training period irrespective of the level of CMAS course. In our study, while CMAS\*

divers were accepted as the inexperienced group (Group A), divers with CMAS\*\* and CMAS\*\*\* certificates were evaluated in the advanced and experienced group (Group B).

The first investigator is a registered diving instructor of TBK, and works as a medical consultant in the club's scientific committee. The divers were referred by the director of the course to the investigator when a health problem related to diving had been suspected. During the study period of 5,5 years, 482 divers were certified by TBK, and had their CMAS 1, 2, or 3 star certificates. Ninety-seven divers (20.1%) were referred to the first investigator with the complaint of pain around the temporomandibular and auricular area with an initial suspect of an otic barotrauma or an otitis externa. The referred divers were classified according to their CMAS degrees [MAS\* (n=59) and CMAS\*\* (n=36), CMAS\*\*\* (n=2)].

After a general otolaryngologic history taking and noting the diving certificate level of the diver, the symptoms related to a TMD [S1. dull or aching pain of the jaw during chewing, biting, yawning, and mouth-piece gripping (in the course of diving and/or post-dive activities); S2. restricted jaw movements; S3. toothache and sensitivity of teeth without any sign of dental infection; S4. otalgia without a sign of ear infection; S5. headache; S6. clicking, popping or grating sound during the jaw movements; S7. tinnitus; S8. nausea and vestibular dysfunction; S9. an increased effort spent for holding the mouth-piece during a dive with a feeling of facial and/or jaw tiredness; S10. loss of sensitivity of the face and lips] were routinely questioned. For the classification of these symptoms, a "visual analogue scale (VAS)", graded from 0 to 9 (e.g., "grade 9" represented the most severe complaint level of a symptom) was used.

During a routine otolaryngologic examination, signs related to a TMD [PS1. a decrease in the range of TMJ movement; PS2. a deviation during the mouth opening; PS3. TMJ tenderness and trigger point activation with palpation of the definite muscle and/or TMJ; PS4. occlusion problems (PS, physical sign)] were evaluated. The severity of physical signs were graded (0, no signs detected; 1, mild intensity; 2, moderate intensity; 3, severe intensity).

After a definite diagnosis of TMD, a conservative approach was the initial therapeutic approach. The divers were informed about the TMDs and myofascial pain. The avoidance of clenching during diving was emphasised. Soft diet, moist heat application to increase the circulation around the tense jaw muscles, isometric jaw exercises (e.g., massage of painful muscles, muscle stretching, gentle isometric tension exercises against resistance, and relaxation techniques), correction of body posture, providing a proper sleeping position, and elimination of para-functional habits (e.g., clenching or teeth grinding and lip or cheek biting) were advised. Isometric muscle exercises were practiced with a technician from the dentistry clinic. A muscle relaxant (thiocolchicoside 2x4 mg/day po) and an anti-inflammatory agent (acemetacin 2x60 mg/day po) were routinely used.

During the medical and conservative therapy, the divers with TMD were advised to refrain from the diving activities, and postpone the training. When recommended by the first investigator and the course director, the trainer suspended the course, and continued the training in the following training programme. If the diver could not postpone the training, the diver was strongly advised to use a "thermoformable mouth-piece for a customized personal usage". The divers were accompanied during the molding process. For divers who were

not able to incur expenditure for a customizable mouth-piece, self reconstruction of a standard mouth-piece proper to the jaw structure was advised. The divers were assisted by the first investigator during the self-reconstruction procedure of the mouth-piece. During a consequent course, the divers were advised to change their behaviour of gripping the mouth-piece.

The patients with no improvement after a conservative approach were evaluated by magnetic resonance (MR) imaging of TMJs, in both closed- and open-mouth positions, and were consulted with the oral surgeon from the "School of Dentistry, Department of Oral and Maxillofacial Surgery". If it was deemed to be necessary by the oral surgeon, an occlusal splint was prepared and used for a period of minimum 6 weeks.

All of the data obtained were coded and entered in "Prism 5 for Mac OS X Version 5.0d". Appropriate statistical analysis with a two-tailed t-test was performed for data that followed a Gaussian distribution. Fisher's exact test was used for the comparison of the prevalence of TMD between the CMAS experience groups. A significance level of  $p < .05$  was chosen to define statistical significance.

This report was approved by the ethics committee of "Istanbul Medipol University, Faculty of Medicine" in 2010 and carried out in accordance with the Declaration of Helsinki. Informed and full consent has been received from the divers for sharing and publishing the data of this study. An additional approval was also taken from the ethical board of the diving club, TBK in 2007. TBK ([www.tbk.org.tr](http://www.tbk.org.tr)) was established in 1954, and is one of the oldest diving clubs in the world

## RESULTS

Fourteen divers were classified according to their experience levels: 12 divers were CMAS\* (85.7%) and 2 divers (14.3%) were CMAS\*\*. TMD was not detected in any CMAS\*\*\* diver. Among the referred patients (n=97), it was found that TMD was seen more frequently in Group A (CMAS\* divers) than in Group B (CMAS\*\* and CMAS\*\*\*divers) ( $p=0.0434$ ).

The most prevalent complaints were "an increased effort spent for holding the mouth-piece during a dive with a feeling of facial and/or jaw tiredness (S8)", "dull or aching pain of the jaw during chewing, biting, yawning, and mouth-piece gripping in the course of diving and/or post-dive activities (S1), and "restricted jaw movements" (Table 1). The symptoms were scored according to VAS grades (Table 1). When symptoms were compared between Group A (CMAS\* divers) and Group B (CMAS\*\* and CMAS\*\*\*divers), no statistically significant difference was found ( $p=0.3819$ ). When both groups were counted together, the highest mean VAS score was for "an increased effort spent for holding the mouth-piece during a dive with a feeling of facial and/or jaw tiredness" (VAS score for S8 was detected to be 6 out of 9) (Table 1).

In association with these complaints, "TMJ tenderness and trigger point activation with palpation of the definite muscle and/or TMJ (PS1)", and "a decrease in the range of TMJ movement (PS1)" were the mostly seen physical signs (Table 1). In the course of therapy, 11 divers (78.6%) had an improvement of symptoms with conservative approach and/or medical treatment. Nine divers (64.3%) of this subgroup postponed their training and had no remarkable recurrence of

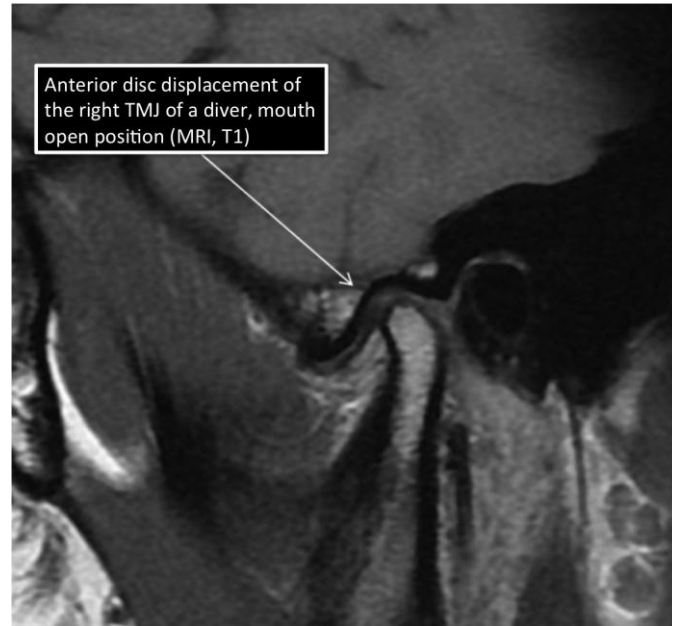
symptoms during the consequent training programme. Two divers (14.3%) of this subgroup had to continue on their training, but reported an improvement of symptoms during the course of training. All divers used customized mouth-pieces whether the training programmes were postponed or not and acted upon the recommendations of the course director and the first investigator.

**Table 1.** Demographics of the SCUBA divers with a definite temporomandibular disorder (TMD), VAS scoring of TMD symptoms (on a scale from 0 to 10) and TMD physical signs (on a scale from 0 to 3) [Pt, patient; CMAS, diving certificate degree; S, symptom (i.e., S1, dull or aching pain of the jaw during chewing, biting, yawning, and mouth-piece gripping; S2, restricted jaw movements; S3, toothache and sensitivity of teeth without any sign of dental infection; S4, otalgia without a sign of ear infection; S5, headache; S6, clicking, popping or grating sound during the jaw movements; S7, tinnitus; S8, nausea and vestibular dysfunction; S9, an increased effort spent for holding the mouth-piece during a dive with a feeling of facial and/or jaw tiredness; S10, loss of sensitivity of the face and lips); PS, physical sign (PS1, a decrease in the range of TMJ movement; PS2, a deviation during the mouth opening; PS3, TMJ tenderness and trigger point activation with palpation of the definite muscle and/or TMJ; PS4, occlusion problems)]

Pt	Gender	Age	CMAS	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	PS1	PS2	PS3	PS4
1	F	31	*	6	5	0	2	3	0	0	0	7	0	2	0	2	0
2	M	19	*	5	5	0	2	2	2	0	0	5	0	2	0	1	0
3	M	18	*	8	6	2	3	4	0	0	0	8	1	3	1	3	1
4	M	31	*	4	5	0	1	2	0	0	0	6	0	2	1	2	1
5	F	24	*	7	7	0	0	4	3	0	0	8	2	3	2	3	2
6	M	21	*	6	4	0	1	1	0	0	0	6	0	1	1	1	0
7	M	33	*	5	6	0	2	0	2	0	0	4	1	2	0	1	0
8	F	22	*	8	9	2	4	5	2	0	2	7	1	3	1	2	1
9	M	28	*	7	6	1	2	3	3	0	0	7	0	2	1	2	0
10	M	21	*	5	3	0	2	0	0	0	0	3	0	1	0	1	0
11	M	26	*	6	5	0	0	3	3	0	0	5	1	2	0	2	0
12	F	22	*	6	6	0	1	4	1	0	0	3	0	2	0	2	0
13	F	44	**	5	5	0	1	0	0	0	0	3	0	2	0	2	0
14	M	31	**	6	3	0	0	2	1	0	0	4	0	1	0	2	0

In the remaining 3 divers (21.4%) (Pts 5,8, and 9 in Table 1), no improvement was detected during the follow-up period with a conservative approach and the symptoms recurred in the second training period. The patients were evaluated with an oral surgeon for a possible anterior disc replacement with or without reduction, inflammation in the retrodiscal area, or a subluxation of the joint. TMJ MRI scans showed unilateral anterior disc replacement with reduction in all patients of this subgroup (n=3, 21.4%) (Figure 3). In these patients, the medical and conservative treatment approach was supported with an occlusal splint. Using an occlusal splint provided an improvement in the divers after an average usage period of 4.2 months (range, 3 months- 7 months).

The average period of follow-up is 14 months (range, 6 months- 28 months) with no recurring TMD complaints in 13 patients. TMD symptoms recurred in 1 patient (Pt. 5 in Table 1) in the following diving season, during a higher-rank CMAS training programme. The patient continued on diving training and was followed conservatively.



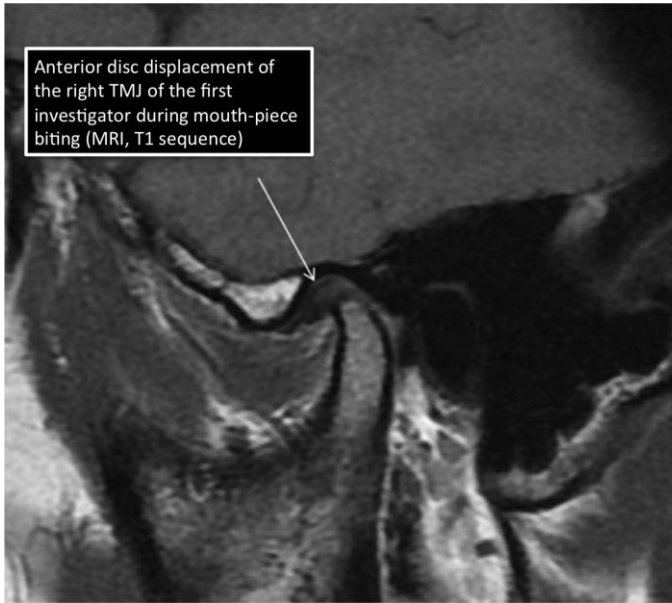
**Figure 3.** Sagittal oblique T1-weighted MR image (closed-mouth position) showed an anterior disc replacement in a diver with TMD.

**DISCUSSION**

There are many external factors that place undue strain on the TMJ and masticatory muscles. SCUBA divers constitute a distinct population with an increased risk of TMD. The use of a SCUBA mouth-piece leads to micro-trauma of the TMJ, chronic hyperactivity of the masticatory muscles and a structural temporomandibular instability (1,2,8,14). Most dives last at least 30 minutes, and most divers perform at least 2 dives per day which is a factor increasing the mandibular masticatory muscle fatigue with exacerbation of TMD (3).

The divers bite interdental bite platforms of the mouth-piece to stabilize the whole second stage (8). Upper and lower incisors, canines and premolar teeth serve as locking frames during interdental bite platform compression. An additional reinforcement of the "palatal handles" beneath the teeth assists stabilization. The tension created by a springing low-pressure regulator hose has to be countervailed all through the diving activity. In order to accomplish proper position of the mouth-piece, the gripping function is facilitated by anterior protrusion of the mandible and TMJ with masticatory muscle strain (3,8,14). The human masticatory musculature has limiting anatomic and functional characteristics, and is not fully evolved for coping with carrying the total weight of the second stage of the regulator in this abnormal position (1,8). Anterior disc displacement action causes a lack of posterior support and an uneven loading on TMJ and masticatory muscles (8). The direction of the joint load and the application point of the biting force moves the point of pressure to the retrodiscal structures and the peri-articular muscles which are rich in neurovascular elements (Figure 4) (2,3).

In addition to the articular pressure created by a mouth-piece during the course of SCUBA diving, individual anatomical differences, joint laxity, degenerative joint disorders, joint disc displacement, capsulitis, inflammation of the periarticular muscles and occlusion problems of the TMJ lead to TMD with various myalgic pain syndromes (2).



**Figure 4.** The anterior disc replacement is seen more often than it is expected. A demonstration has been performed by the first investigator who has no symptoms related to TMD. The mean of the last 100 dives of the first investigator was measured by using “SmartTRAK 2.8 software of the diving computer Aladin 2G”, and was found to be 37 minutes. According to this diving time, the first investigator gripped a conventional mouth-piece for 37 minutes. After detaching the mouth-piece from the demand valve of the second stage of the regulator, temporomandibular joint of the first investigator was evaluated by MR imaging with the mouth-piece compressed between the upper and lower teeth. Sagittal oblique T1-weighted MR image showed an anterior disc displacement.

An increased incidence of TMD is observed during the diving certification programmes. The **unroutine** diving activities performed by the trainees during a diving training increase anxiety and psychological stress. In Turkey, sea temperatures change between 15<sup>0</sup> C to 24<sup>0</sup> C during a diving season (18). This temperature interval is accepted as “cold-sea diving” by most SCUBA divers. Physical (e.g., cold, factors associated with depth and duration of dive, poor physical condition) and psychological stress (e.g., lack of diving experience, problems of adaptability to the surrounding hydrostatic environment, fatigue and incompetency of using and manipulating diving equipment) causes a significant increase in TMJ parafunctional activity during diving (1,11). In conditions of stress, as are frequently encountered in diving, the tendency is to clench the teeth tightly with an increased physical straining on mandibular masticatory muscles and loading on TMJs (9,11). The resultant painful TMJ functions reinforce the emotional alterations, which may induce increased subaquatic risks.

The signs and symptoms of TMD include pain in the TMJ, muscles of mastication, preauricular area and ears usually aggravated by manipulation or function, TMJ clicking or crepitus, trismus, asymmetric and impaired TMJ mobility, headache and facial pain, masticatory muscle pain, stuffiness of the ears, malocclusion, deviation or deflection, limited range of motion, eustachian tube dysfunction, tinnitus and nausea due to labyrinthine dysfunction (1,5,7,19,21). In our study, “pain of the jaw during chewing, biting, yawning, and mouth-piece gripping”, “an increased effort spent for holding the

mouth-piece during a dive with jaw tiredness” and “restricted jaw movements” were the most prevalent symptoms. It has been reported that the use of a SCUBA mouth-piece causes a local inflammation in the TMJ (19). TMJ pain is reported in 24-65% of the divers using a conventional mouth-piece (1,8,20). According to Hobson, 68% of the dental pain in the divers is attributed to TMJ pain (8). In divers, mouth-piece gripping may also aggravate a previous TMD (8,19). Divers maintain the prone position and extend the head. The incidence of TMD is increased in patients with postural abnormalities, which is routine during diving activities (17). TMDs are best evaluated with MR imaging (13). The articular disk is evaluated in both closed- and open-mouth positions. The presence of a displaced disk is a critical sign of TMD. Rupture of retrodiscal layers and TMJ effusion must also be sought.

The assessments of the masseter muscle with EMG showed different levels of muscle tension with various mouth-pieces (12). Customized mouth-pieces are held in the mouth with less muscle activity (15), so research has to be carried out to improve the design of the mouth-piece. “Specially manufactured mouth-pieces for a TMD” or “thermoformable mouth-pieces” provide significant advantage over the standard club-type mouth-pieces (16). Researchers reveal the factors important in mouth-piece manufacture (e.g., assess the effectiveness of the materials and determine the structural specifications) and incorporate them into second stages of diving regulators. It is recommended that a mouth-piece must have an interdental bite platform with a thickness of less than 4 mm placed between the premolar and molar teeth and a width less than 8 mm, the thickness should not exceed the interocclusal gap, the bite platform should be positioned further posteriorly between canine and premolar teeth, and the intraoral labial screen should extend in the labial and buccal area in accordance with the sulcus of the mouth and must not extend more than 2 mm behind the biting blocks (6,9,15). The screen should be notched to prevent muscle and frenulum impingements. The mouth-piece must be reconstructed from silicone rather than rubber (6,15). Full face masks may be used and advised for professional divers with TMDs. Divers are advised to try their mouthpieces before buying (10).

Conservative approach should initially be tried for the treatment. Different classes of drugs (e.g., non-steroidal anti-inflammatory drugs, steroids, muscle relaxants, and anti-anxiety agents) may be prescribed (4,14,21). Heat, exercise therapy including active and passive jaw movements, correction of body posture during diving and post-dive activities and relaxation techniques relieve myofascial pain in TMDs (4,17). If an outcome with a relief in pain intensity and a decrease in the duration of symptoms are not detected, stabilization splint therapy is advised (4,14,22).

Diagnosing TMD is important from an aspect of subaquatic health. TMDs are reported to cause eustachian tube dysfunction and labyrinthine dysfunction (19) and an increased risk of otic barotrauma. When the TMJs are overstrained by gripping the mouth-piece for an extended period of time, venous and lymphatic return from the TMJs and middle ear may be blocked, causing an edema and blockade of the eustachian tube (19). Eustachian tube dysfunction during diving leads to barotrauma. Myofascial pain causes discomfort during underwater activities, impedes

the performance during diving training, and may force the diver to abort the diving activity (1). The TMJ pain can be misdiagnosed as barodontalgia, eustachian tube dysfunction and otic barotrauma (3,8,19). TMJ pain from repeated mouth-piece usage may commonly be mistaken for an inability to equalize middle ear pressure.

The effort for stabilizing the mouth-piece of the second stage of a diving regulator is a recognized factor in TMD development. The training for diving certification causes an increase in the prevalence of TMD by intensifying anxiety. Attention should be paid by otolaryngologists to an association of diving with TMD especially in inexperienced divers. Further research is necessary to design an efficient mouth-piece useful for reducing the risk of developing TMD.

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