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Mini Review

Bite Anomalies Related to Headache, Vertigo, Sensorineural Hearing Loss and Orthopedic Cases

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Abstract

A five-year follow-up of temporomandibular joint clicking in children aged 5 to 10 years found that approximately 4% of the children had persistent clicking. It has been reported that this clicking occurs due to the occlusal discrepancy between habitual occlusal position and muscular position. This discrepancy has been reported to cause headaches, vertigo, sensorineural hearing loss, and orthopedic symptoms. The background of these reports was explained and the physiologic occlusal analysis were described.

Keywords: *Headache; Vertigo; Sensorineural Hearing Loss; Coxalgia; Median Nerve Palsy*

Temporomandibular disorders (TMD), which is characterized by symptoms such as difficulty opening the mouth, facial pain and headaches, to understand at what age it begins and what its course takes, an observation of TMJ (temporomandibular joint) sounds, that is one of TMD symptoms, was performed from 1987 to 1992. As the results of a five-year observation of the jaw joint sounds of Japanese children [1], a total of 79 subjects was examined. Clicking was observed in 30 subjects, of which 26 subjects had temporary clicking, and 3 subjects had persistent clicking. When permanent teeth erupt, if they do not erupt in a position that allows the masticatory muscles to function optimally, the position of the tooth is adjusted by muscle force, that is bite force, causing a clicking sound; once the tooth is in the optimal position, the clicking sound disappears. Girls click more frequently (Figure 1). This is thought to be because girls have a smaller bite force than boys, which means it takes longer to adjust the position of the teeth, the period during which clicking occurs is longer, and it is more frequently detected during health checkups.

Subjects with persistent clicking had significantly lower bite forces at around age 6, around the time of first molar eruption (Figure 2). Thus, the occlusal discrepancy between the habitual and muscular positions during mixed dentition may have appeared as a result of small bite force, and this discrepancy have been maintained once the permanent dentition was achieved, resulting the persistent clicking.

Table 3 Contingency table for male and female subjects with or without TMJ clicking

Gender	with clicking	without clicking	total
Male	11	19	32
Female	19	12	30

P = 0.042 (The relationship between girls and clicking was significant when evaluated using the Fisher exact test).

Figure 1: *Statistical results obtained from a five-year observation.*

Table 6 Maximum bite force (kg) of subjects with and those without persistent TMJ clicking (continuing for more than two years)

Subjects	1988	1989	1990	1991	1992
No. 12 and 18	29.5 ± 2.1	39.5 ± 2.1	39.5 ± 12.0	72.0 ± 19.8	50.5 ± 12.0
Other subjects	30.4 ± 12.5	36.8 ± 17.7	47.1 ± 20.6	46.6 ± 20.0	50.7 ± 27.1
No. 31 and 46	17.0 ± 18.4 †	27.0 ± 21.2	25.5 ± 26.2	17.0 ± 14.1	38.0 ± 31.1
Other subjects	31.5 ± 17.0	40.0 ± 23.2	50.0 ± 27.1	44.0 ± 22.5	52.8 ± 17.1
No. 59 and 60	29.7 ± 10.0	50.7 ± 10.0	46.5 ± 13.4	58.0 ± 0	49.0 ± 11.3
Other subjects	43.8 ± 8.6	52.6 ± 17.7	56.6 ± 22.0	62.8 ± 31.4	75.3 ± 31.3

†P < 0.005: significant

Figure 2: *Statistics of bite force.*

In those with clicking, the habitual occlusal position does not coincide the muscular position (Figure 3).

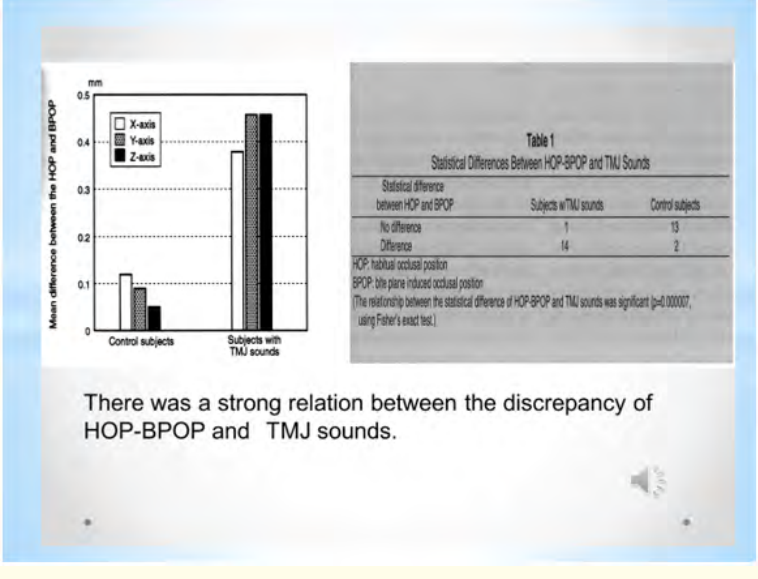

Figure 3: *Relationship between occlusal discrepancies between muscular position (BPOP) and habitual occlusion position (HOP) and temporomandibular joint sounds.*

This patient visited us with her chief complaint of TMJ pain on the right side accompanied by clicking sounds.

She was a 17 years-old high school student. She has been aware of TMJ clicking since the age of 12. After wearing a bite plate, her pain was relieved and occlusal analysis in the muscular position was performed. The analysis indicated premature occlusal contacts on the second molars on both sides (Figure 4). Occlusal adjustments in the muscular position were performed four times (occlusal position correcting therapy), and the clicking and pain totally disappeared after 5 weeks of treatment [2,3].

Figure 4: *Results of occlusal analysis in muscular position in the patient with temporomandibular joint pain.*

This 25-year-old female patient visited us with the chief complaint of limited jaw opening and pain in the right temple, neck and shoulder (Figure 5). She reported tenderness on the palpation of the left TMJ, the right anterior temporalis, the right platysma and sternocleidomastoid, and the left external and medial pterygoid muscles The maximum unassisted opening was 28 mm. The opening path deviated to the left side. Occlusal discrepancies were recorded on the disks.

Figure 5: *Patient with various facial pain and opening disability.*

Red indicates muscular position and blue indicates habitual occlusal position (Figure 6).

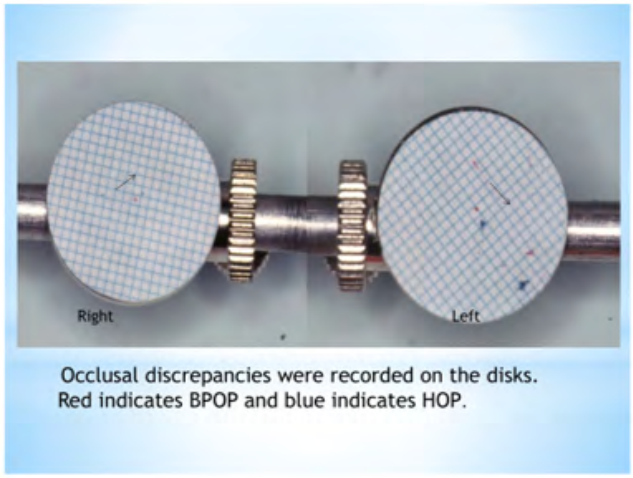

Figure 6: *Occlusal discrepancy between muscular position (BPOP) and habitual occlusal position (HOP) of the patient.*

She reported a earfullness on the left side and eye symptoms (flashing in the bottom of the eyes). She was diagnosed as having myofascial pain with limited jaw opening. After removing the interferences, the muscle tenderness of the shoulder, neck, and occiput on the right side completely disappeared. Eye symptom and ear symptom also disappeared (Figure 7). She completely recovered 3 months after the first examination. Regarding eye symptom, it is thought that excitation of the trigeminal motor nucleus causes excitation of the ophthalmic nerve, resulting in eye symptoms. It is also thought that tension in the masticatory muscles caused tension in the tensor tympani muscles, resulting in a feeling of stuffed ear.

Figure 7: *The patient after treatment.*

A 31-year-old woman visited us with a complaint of a sound in her left temporomandibular joint. She had been suffering from chronic headaches for 6 years [4]. She reported that she had taken a break from work due to a headache. She was diagnosed with migraine by a neurosurgeon and treated with naratriptan hydrochloride and romelidine hydrochloride (Figure 8). However, no reduction in headaches was observed.

Figure 8: *Oral cavity of the patient with chronic headaches.*

Tenderness of the lateral and medial pterygoid muscles and the left trapezius muscle on both sides on palpation was observed. Premature occlusal contact was noticed in the right first premolar (Figure 9). Occlusal adjustments were made five times. The number of doses of naratriptan was significantly reduced after occlusal adjustment, and chronic headaches quickly turned into episodic headaches (Figure 11). After the fourth month, the headache is almost gone. This is the records of jaw movements from the first contact point to habitual occlusal position (Figure 10). These movements couldn't be produced by masseter and temporal muscles, but lateral and medial pterygoid muscles. The shift from the muscular position to the habitual occlusal position implies the need for extra muscular activity of the lateral and medial pterygoid muscles (Figure 10). These muscles are smaller than the masseter and temporal muscles. Therefore, these movements, repeated in chewing, exceed the active capacity of these muscles, causing myofascial pain. The patient is not able to feel pain in the myofascial of the lateral and medial pterygoid muscles. Therefore, the patient's body emits the referred pain in places on both sides of the head as alarm.

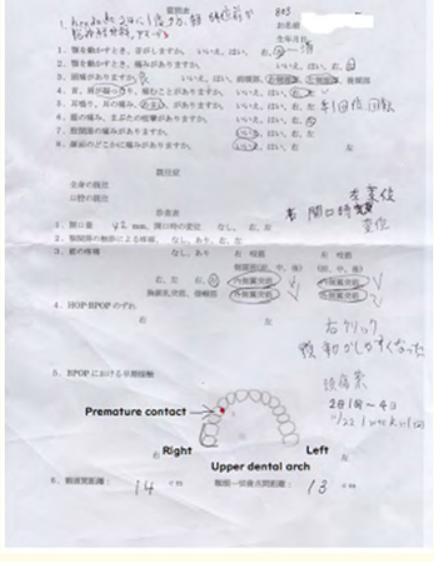

Figure 9: *Premature occlusal contact of the patient.*

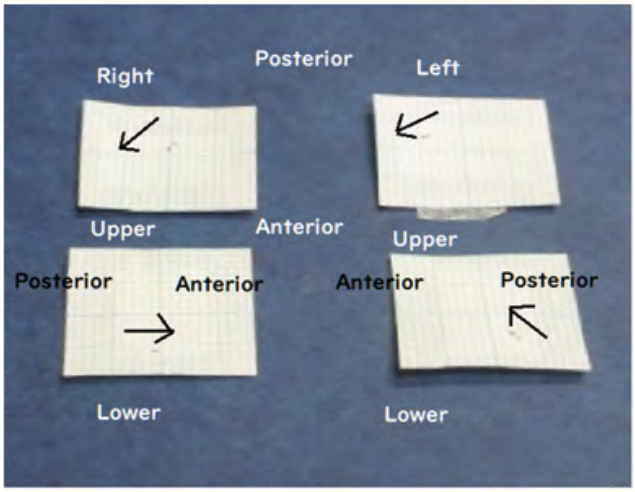

Figure 10: *Three-dimensional analysis of the movement path from muscular position to habitual occlusion position.*

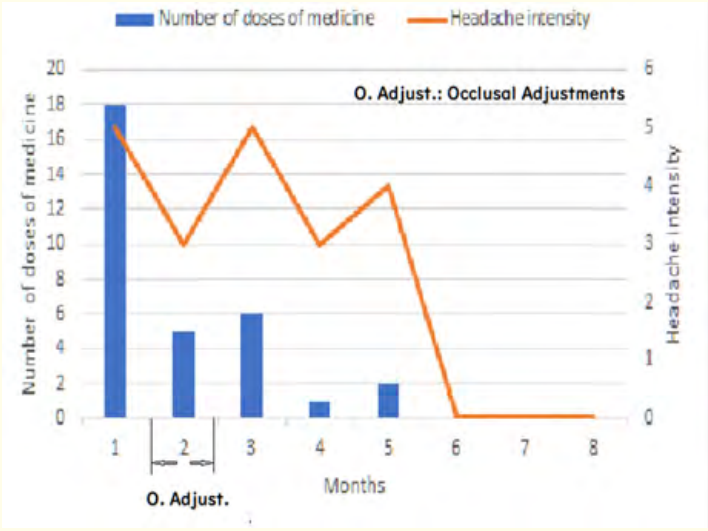

Figure 11: *Relationship between medication frequency and headache intensity before and after treatment.*

A 75-year-old man visited us with a complaint of loose full upper denture (Figure 12) [5]. He had to visit the emergency room of a medical hospital two years before his first dental visit. He reported feeling a strong impact in his left ear and then developing severe rotational vertigo. No brain abnormalities were detected. He reported that while he was sitting on a stool and looking at a point on the wall in front of him, his visual point repeatedly moved from the right to the left. A half-rotational shift from the muscular position to the habitual occlusal position was detected on the disc of the mandibular position analyzer (Figure 13). The denture was modified by adding self-cure resin to the occlusal surfaces of both molars because there was no occlusal contact of the bilateral molars due to premature occlusal contact at the muscular position. The vertigo disappeared and the tinnitus decreased. Frequent and short, periodically repeated

half-rotational shifts in chewing and other oral functions are recognized as rotational movements, causing nystagmus, giving the patient the illusion of rotation and causing vertigo. Alternatively, it has been reported that nystagmus can also be caused by pouring cold water into the ear canal, so the following may be possible. Since patients with BPPV (Benign Paroxysmal Positional Vertigo) report feeling a strong impact in the ear just before an attack, it is thought that the sudden change from muscular position to habitual occlusion position causes the tensor tympani muscle to contract rapidly, tensioning the eardrum, and this impact is transmitted to the inner ear via the ossicles, acting on the otolith, causing nystagmus. Nystagmus is thought to be a defensive reflex to maintain balance during rotational movements, so if you change your posture even slightly when nystagmus is occurring, you will immediately lose your balance and fall over. It is believed that by making the muscle position with the habitual occlusal position consistent, it is possible to prevent the sudden contraction of the tensor tympani muscle, prevent the occurrence of unnecessary nystagmus, and prevent the onset of rotational vertigo.

Figure 12: *Oral cavity of the patient with vertigo.*

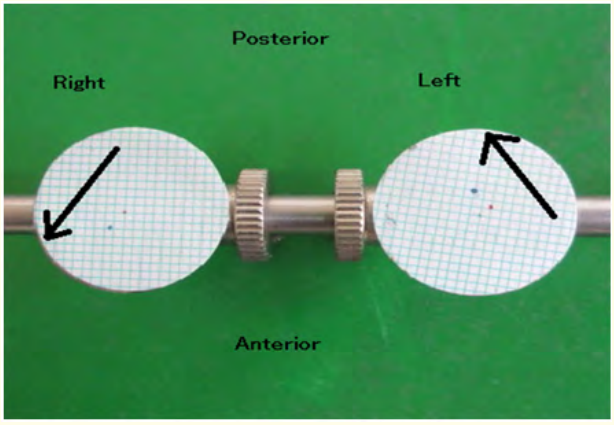

Figure 13: *Shifts from muscular position to habitual occlusal position.*

A 66-year-old woman visited us with a complaint of a third molar in the lower right side (Figure 14). She had tinnitus in her right ear, difficulty hearing low-frequency sounds, and ear fulness, and first she went to an ENT clinic. As a result of various tests, she was

diagnosed with sudden hearing loss and low-frequency hearing loss. She was treated with oral steroids such as isosorbide, diphenidol, and domperidone, but there was no improvement. She complained of difficulty jaw movements, right shoulder stiffness, ringing in the right tinnitus, low-frequency hearing loss, and sounds and pain in the temporomandibular joint, including ear fulness in the right ear. Premature occlusal contact was noted in the right second molar (Figure 15). The lower jaw is deviated backwards from the muscular position by 2 mm (Figure 16). After the occlusal adjustments, the symptoms of temporomandibular joint sound, right tinnitus, right shoulder stiffness, low-frequency hearing loss, and ear fulness of the right ear all disappeared. When the temporal muscles contract strongly and the teeth meet together, the tensor tympanic muscle contracts synchronously, which restricts the movement of the chain of the tiny ear bone, causing low-frequency hearing loss and ear fulness (Figure 17).

Figure 14: *Oral cavity in the patient with sensorineural hearing loss.*

Figure 15: *Premature occlusal contact of the patient.*

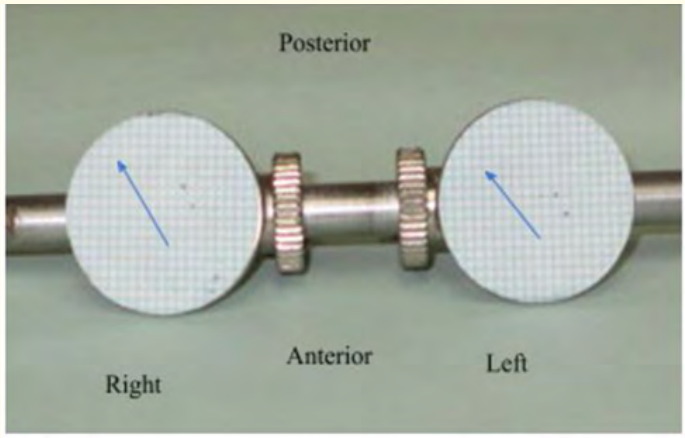

Figure 16: *Shifts from muscular position to habitual occlusal position of the patient.*

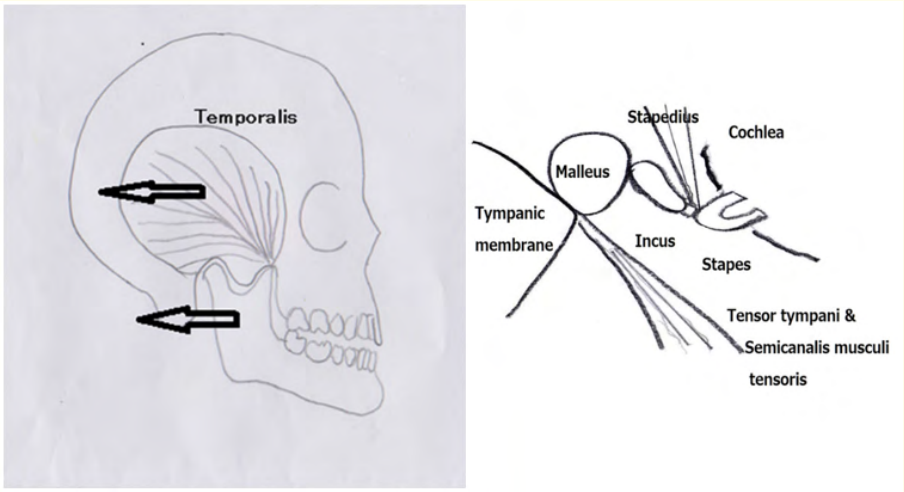

Figure 17: *Relationship between masticatory muscles and tensor tympany.*

Initially, contraction of the tensor tympany muscle occurs intermittently only when the teeth bite each other. However, if the contraction is repeated and prolonged, the tympanic tensor muscle becomes fatigued, the muscle tone becomes persistent, result in hearing loss.

59-year-old woman presented with the chief complaint of detachment of the crown of the lower right second molar (Figure 18). She reported that she was pointed out as having a high-frequency hearing impairment in the right ear at the complete medical checkup (4000Hz: 40dB). Premature occlusal contacts were recognized on the left first premolar and first molar (Figure 19). Occlusal adjustment was performed twice, but the gap in the right lower premolar and molar regions did not disappear (Figure 20), so the temporary crowns of the right premolars and molars were fabricated to fill the gap. As a result, the opening amount was improved to 47 mm. The sounds of left TMJ disappeared, and the opening path became straight. Tenderness on palpation of the left trapezius, medial and lateral pterygoid muscles also disappeared.

Figure 18: *Oral cavity of the patient with high-frequency hearing loss.*

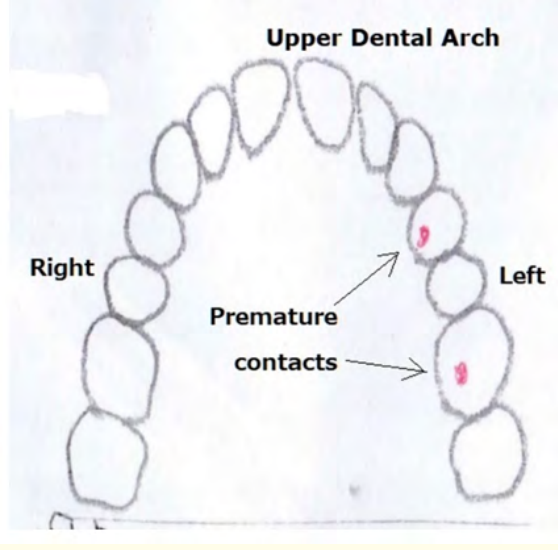

Figure 19: *Premature occlusal contacts of the patient.*

Figure 20: *Occlusal gap on the right side.*

The bite force on the right side improved from mean 5.3 kg before the occlusal correction to mean 10.0 kg after the occlusal correction (significant at $p<0.05$). The bite force on the left side was mean 14.0 kg before the occlusal correction and mean 12.0 kg after the occlusal correction (no significant). In the present case, since the right premolars and molars were not in occlusion (Figure 21), the right masticatory muscles were not capable of isometric contraction, and the contracting force of the muscles were weak. The contracting force of the right tensor tympani, which receives the same innervation, is thought to be weakened. Therefore, it is thought that the tension of the right tympanic membrane was weak and high frequency sounds were difficult to transmit (Figure 22).

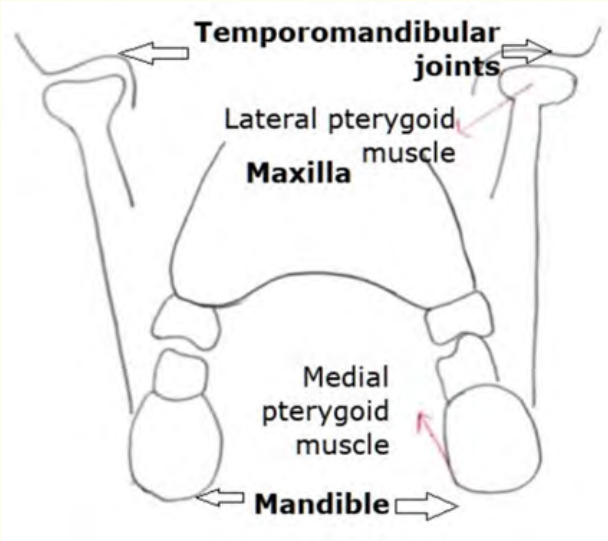

Figure 21: *Occlusal gap on the right side.*

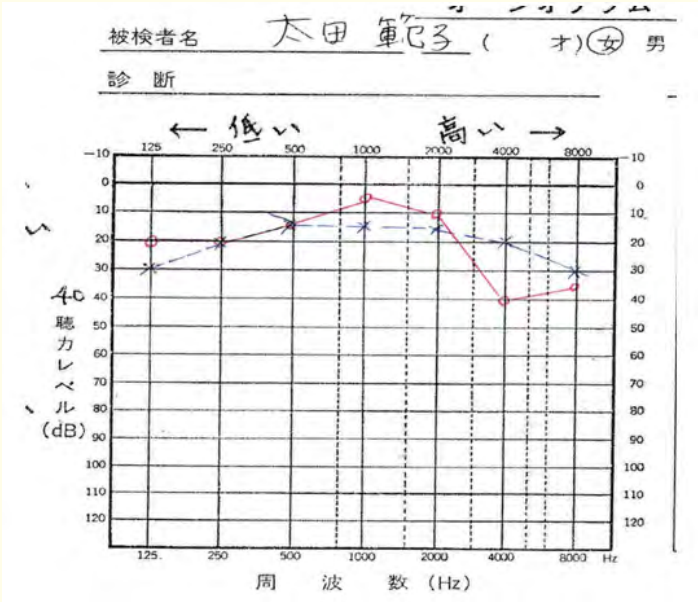

Figure 22: *Audiogram of the patient: Red line indicates before treatment; blue line indicates after treatment.*

A 44-year-old female patient visited us with severe pain in her left temporomandibular joint and a clicking sound (Figure 23 and 24) [8]. She also reported that the coxalgia on her left side, six months before the first visit. X-rays of her hip joints showed no abnormalities (Figure 25). Her habitual occlusal position was deviated 1 mm posteriorly from the muscular position on the left side and 1 mm anteriorly on the right side (Figure 26). Patients with temporomandibular disorders may have occlusal discrepancy, resulting in an imbalance in the posture of the mandible, head and neck. Thus, the iliopsoas and quadriceps muscles may compensate to maintain body posture, resulting in poor overall posture in TMD patients. When the quadriceps muscle continuously acts on the hip joint, it can cause coxalgia. The hip pain in the patient in this case may be attributed to this mechanism (Figure 27). This patient complained of tearing pain in the left thigh (Figure 28).

Figure 23: *Occlusal status of the patient with temporomandibular joint disorder and coxalgia.*

Figure 24: *Oral cavity of the patient.*

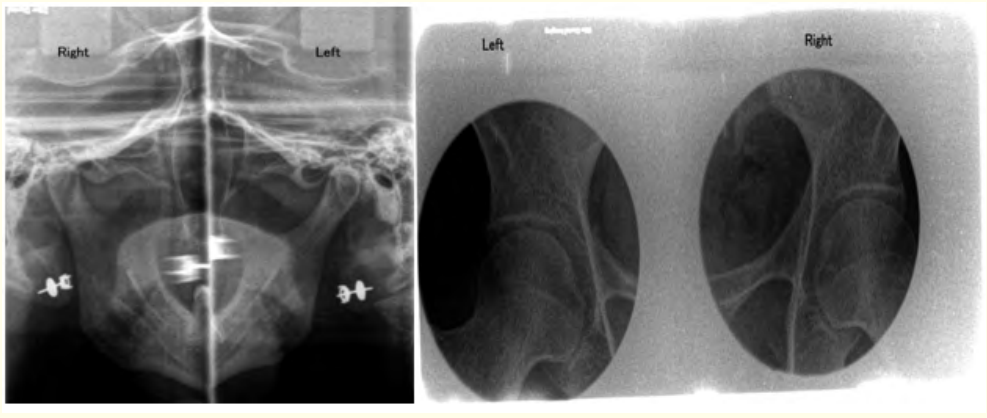

Figure 25: *X-ray of hip joints of the patient.*

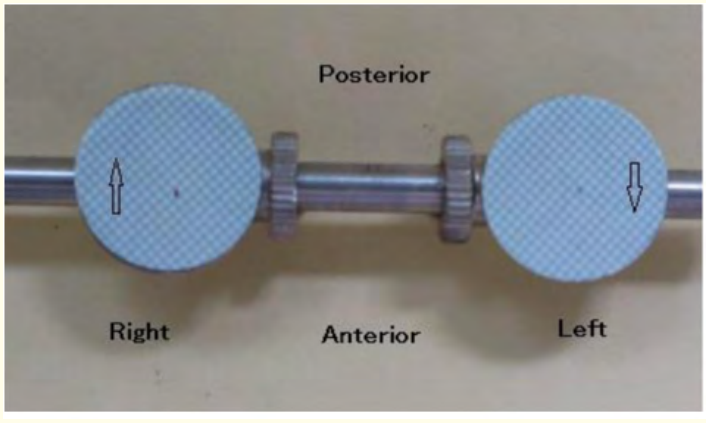

Figure 26: *Shifts from muscular position to habitual occlusal position.*

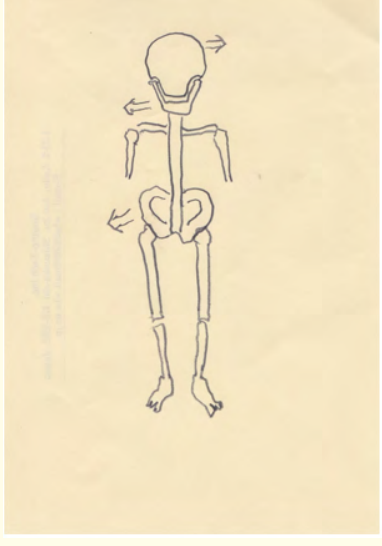

Figure 27: *The relationship between occlusal discrepancy and posture control.*

Figure 28: *Patient complaining of severe thigh pain.*

The shifts from the muscular position to the habitual occlusal position were shown in figure 29. The pain disappeared after the occlusal adjustments.

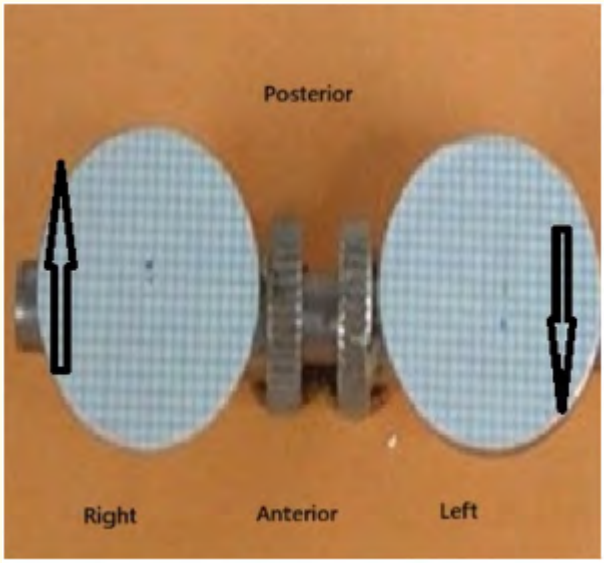

Figure 29: *Shifts from muscular position to habitual occlusal position of the patient.*

A 68-year-old woman presented with the complaint of food getting stuck in her right upper premolars (Figure 30) [9]. She reported that three months earlier she had lost the ability to pinch with her right thumb and forefinger and had been seen by an orthopedic surgeon who was diagnosed with a median nerve palsy of unknown etiology (Figure 31). The bite force was then measured at the first molars using an occlusal force meter. The mean value was 37 kg on the right side and 13.3 kg on the left side, respectively. The statistical difference between the mean values was significant ($p<0.005$). Regarding the occlusion of the upper and lower models, the right molar

Figure 30: *Oral cavity of the patient with median nerve palsy.*

Figure 31: *Inability to close right thumb, index finger, and middle finger.*

was not occlusion (Figure 32). Premature occlusal contact was recognized on the left second premolar (Figure 33). Occlusal adjustment was performed according occlusal position correcting therapy [3]. The biteforce became 20 kg on the right side and 21 kg on the left side with no statistical difference. The patient's right hand median nerve palsy disappeared (Figure 34). In the case of this patient, the right posterior teeth were brought into occlusal contact and unconsciously exerted an extremely strong occlusal force. Therefore, it is thought that the molars on both sides were in contact with each other in the muscular position, and that the temporomandibular system was functioning normally without any symptoms. However, if such a state in which an abnormally strong bite force must be constantly exerted continues, the motor nucleus of the trigeminal nerve will be abnormally excited. It was considered that the activity of the trigeminal spinal cord nucleus was suppressed, resulting median nerve palsy (Figure 35).

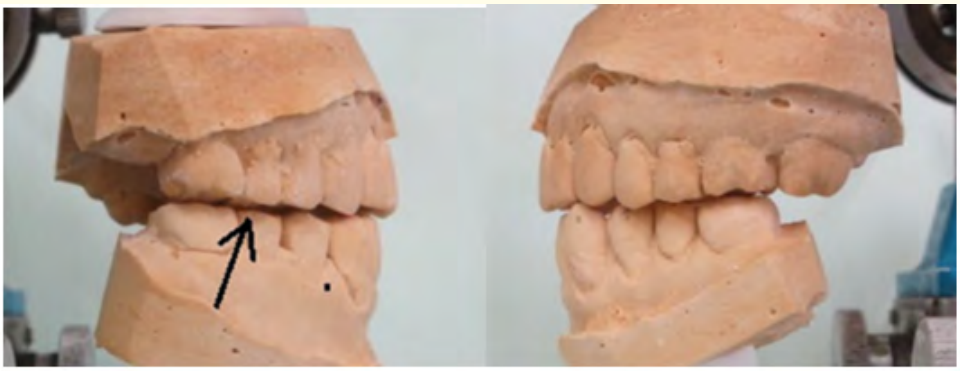

Figure 32: *Occlusal gap on the right side of the patient.*

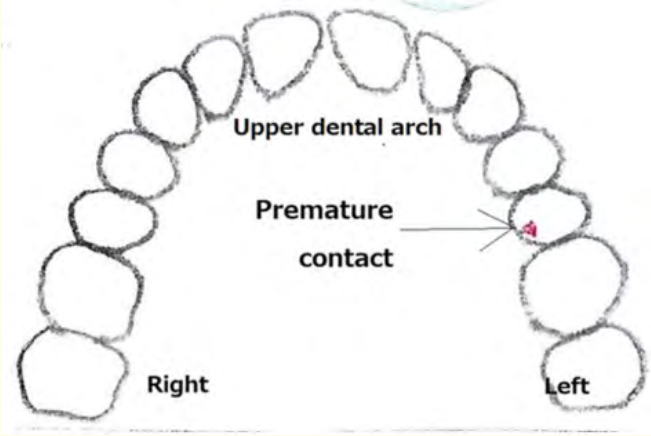

Figure 33: *Premature occlusal contact of the patient.*

Figure 34: *After treatment.*

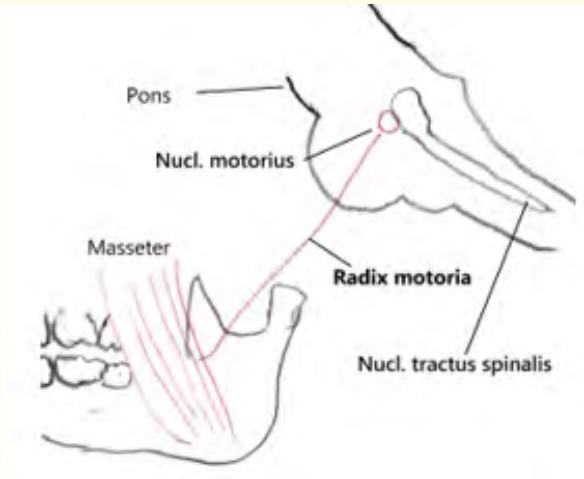

Figure 35: *Relationship between the trigeminal motor nucleus and the spinal trigeminal nucleus in the pons.*

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