Treatment of Head and Neck Area Pain by Multidisciplinary Approach with Template

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Purpose: The headache is a symptom that various somatic or non-somatic disorders gives an effect to head and neck system. The neck and the shoulder pain is a common muscle pain that can not control and bothers the patient after chronic state. The headache and the neck and the shoulder muscle pain are treated with various conventional treatment methods. But, there are cases that symptoms did not resolve or increased in some clinical cases. And generally, the result of temporomandibular disorders (TMD) treatment is good. But, despite of a normal treatment was performed for TMD, there are cases that TMD symptoms did not resolved in clinical cases. In template clinic of Soonchunhyang University Bucheon Hospital, co-operative neurophysiologic treatment of Department of Neurosurgery and Dentistry are done for patients, who had head and neck pain or atypical symptoms that did not treated with various conventional treatment method such as surgery or medication etc.

Materials and Methods: Four hundred fifty one patients who have treated in the template clinic, Soonchunhyang University Bucheon Hospital, from January of 2006 to December of 2008 were subjected in this study.

Result: Overall average age was 31.9 years old. Ratio of numbers is 74.3% in female and 25.7% in male. The success rate of treatment in TMD symptom was 89.9%, in headache was 88.8%, in muscle pain was 81.6%. Statistically significance of differences visual analogue scale evaluation between before and after had been treated patients who have over average grade headache was calculated by paired t-test. P<0.05 was considered significant.

Conclusion: We suggest the template appliance can be attempted for cases whose headache, the neck and the shoulder muscle pain and TMD are not resolved with various conventional treatment methods.

Key Words: Headache; Neurophysiology; Template; Temporomandibular disorders
Introduction

Head and neck area pain has various causes\(^1\), and various treatment methods are suggested according to the cause. In clinical situations, however, some patients are dissatisfied with the result of treatment using the existing treatment methods, and some cases are difficult to classify as a specific type including headache, neck pain, shoulder pain, and temporomandibular disorder. Headache is one of the most common symptoms of temporomandibular disorder, which may cause tension headache\(^2,3\). Though various causes of headache have been suggested, there is a need to conduct more research studies to identify the clear cause of headache\(^3\). Note, however, that most cases of tension headache are related to “stomatognathic disorder”; as a result, treatment of stomatognathic disorder including disorder of temporomandibular joint and masticatory muscle is a necessary or a minimal process to control tension headache\(^4\). In addition to the relationship between pain of the neck or facial muscles and tension headache, the relationship between migraine and neck muscles was suggested\(^5\). Many other researchers reported the relationship between headache and posture/muscle ache including pain of the neck and shoulder\(^6\) and improper posture of temporomandibular disorder patients\(^6,7\). Some papers insist that there is no relationship between posture and status of the stomatognathic system such as location of the jaw\(^8\), but many other papers report opposite results\(^6,9\). For these reasons, we believe the adjustment of the stomatognathic system can affect the adjustment of posture\(^6,10\) and pain of the head and neck area. Moreover, many stomatognathic disorder patients have multiple symptoms; thus suggesting the necessity of joint treatment by many departments related to the head and neck area\(^9\).

Based on these theories, we reviewed references and reported a case of patients treated for sharp pain or disorder in the head and neck area - which is not treated by existing methods such as surgery or medication, with joint treatment of neurosurgery and dental clinic using an intraoral device to control the stomatognathic system.

Materials and Methods

1. Subjects
The test subjects were the available patients treated during the period 2006~2008. The total number was 451 (female patients: 335 or 74.3%; male patients: 116 or 25.7%). The average age of female patients was 33.4 (9~78), and that of male patients was 27.4 (8~71). The overall average age was 31.9.

2. Treatment Method
A intraoral template device was used (Fig. 1).

Table 1. Classification with symptoms

<table>
<thead>
<tr>
<th></th>
<th>TMD</th>
<th>Headache</th>
<th>Muscle pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female No.</td>
<td>281</td>
<td>155</td>
<td>158</td>
</tr>
<tr>
<td>Male No.</td>
<td>96</td>
<td>32</td>
<td>49</td>
</tr>
<tr>
<td>Total No. (%)</td>
<td>337 (83.5%)</td>
<td>187 (42.2%)</td>
<td>207 (45.9%)</td>
</tr>
<tr>
<td>Female Ave. age (yr)</td>
<td>32.2</td>
<td>34.6</td>
<td>34.1</td>
</tr>
<tr>
<td>Male Ave. age (yr)</td>
<td>25.3</td>
<td>27.4</td>
<td>28.6</td>
</tr>
<tr>
<td>Total Ave. age (yr)</td>
<td>30.5</td>
<td>33.5</td>
<td>32.9</td>
</tr>
</tbody>
</table>

TMD: symptoms of temporomandibular disorders, Muscle pain: posterior neck pain, shoulder & arm pain, Ave.: average.
Template is a device used to tow the oral occlusal vertical dimension as 10~12 mm. Its location was adjusted regularly to enable balanced posture, and patients used it for 10~12 hours daily when sleeping and doing light exercise.

3. Classification of Symptoms
28.6% had only temporomandibular disorder, 12.6% had temporomandibular disorder and headache, 22.4% had only muscle pain, 19.9% had temporomandibular disorder and muscle pain, 2.9% had only headache, 3.6% had headache and muscle pain, and 10% had other symptoms (bad posture, dizziness, etc.).
83.5% had temporomandibular disorder, 42.2% had headache, and 45.9% had muscle pain (Table 1).

4. Evaluation Method
The symptoms were evaluated using a questionnaire filled out at the first examination, regular follow-up, and treatment. Patients answered 108 questions on symptoms in the interview survey (Appendix). The degree of each symptom was divided into very severe, severe, normal, and no symptom; change of very severe and severe symptoms into normal and no symptoms was regarded as improvement. Likewise, for headache patients, the degree of headache was surveyed before and after visual analogue scale (VAS) treatment.

Result
1. Treatment Success Rate
The treatment rate of temporomandibular disorder was 340/377 patients (89.9%), headache was 166/187 (88.8%), and muscle pain including neck pain was 171/207 (81.6%) (Table 2).

2. VAS Analysis
Before the treatment, the average VAS was 7.5 (7.4 in the female group and 8 in the male group). After treatment, the average VAS was 2.4 (2.5 in the female group and 1.7 in the male group).

The improvement rate, i.e., VAS decreased to less than 4, was 23/29 (79.3%), and the rate of subjective symptom improvement such as decrease of headache frequency was 25/29 (86.2%) (Figs. 2 and 3). After analyzing the VAS values before

<table>
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<th>Headache</th>
<th>Muscle pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>256 / 281 (91.1)</td>
<td>137 / 155 (88.4)</td>
<td>132 / 158 (83.5)</td>
</tr>
<tr>
<td>Male</td>
<td>83 / 96 (86.5)</td>
<td>29 / 32 (90.6)</td>
<td>39 / 49 (79.6)</td>
</tr>
<tr>
<td>Total</td>
<td>339 / 377 (89.9)</td>
<td>166 / 187 (88.8)</td>
<td>171 / 207 (81.6)</td>
</tr>
</tbody>
</table>

TMD: symptoms of temporomandibular disorders, Muscle pain: posterior neck pain, shoulder & arm pain.
Values are improved number/total number (%).

Table 2. Improvement’s rates of symptoms

Fig. 2. Headache patients numbers before template therapy with VAS (n=29). VAS: visual analogue scale.
Fig. 3. Headache patients numbers after template therapy with VAS (n=29). VAS: visual analogue scale.
and after treatment with paired t-test, a statistical analysis, the difference was found to be statistically significant (P<0.05), and the treatment was proven to be effective.

Discussion

Literature suggesting the relationship between the neck muscle and occurrence of headache and migraine report that there is a relationship between migraine, neck pain, and stiffness/tenderness of the neck area; convergence with the trigeminocervical nucleus between the trigeminal pathway and upper-cervical nociceptive pathway means the functional relationship between them for awareness of headache. Another paper reported that such convergence is the basis of the referred pain in the head and upper cervical region, and most referred pains generated after stimulating the neck cephalic nerve fibers occur in the occipital region, forehead, and orbital region. Yet another paper reported that the rate of headache attack occurrence is 34% in the neck and shoulder, followed by 39% in the temporal-parietal region and 37% in the forehead.

To reduce the pain of neck and shoulder, it is important to maintain proper posture at all times; preventing it requires correcting the posture and removing the various factors that may hurt the neck. If the pain is not removed despite such efforts, however, it means that the pain has reached a chronic state, and that the tension of muscle is deteriorating. As a result, not only conservative management but also professional treatments such as invasive treatment are required.

In literature, many factors related to temporomandibular disorder are suggested including genetic and acquired factors, change in the temporomandibular area and musculoskeletal system, arthritis, malocclusion, change in the blood vessel system, structural change such as change in the neuromuscular system, and mental factors such as stress and depression. Nonetheless, more than 2 factors are assumed to be related instead of having one factor at work. Non-invasive, conservative treatments are preferred in the treatment of temporomandibular joint disorder, and they have produced good results; for some patients who have severe and continuous pain or functional disorder and who are not treated by conservative treatment, surgical treatment may be performed. The device used in this study was template, and its background is different from stabilization splint, the most popular intraoral device. It is a device that considers the temporomandibular movement generated based on No. 1 and 2 cervical vertebrae as well as the movement generated based on the temporomandibular joint, according to the Quadrant theorem. Quadrant theorem is a theory on the motor mechanics of the jaw, not only occlusion (Fig. 4).

An intraoral device has been used to treat temporomandibular disorder. Template leads to the improvement of temporomandibular disorder by reducing pressure on the temporomandibular joint and eases pressure on the cervical vertebral portion by pushing the upper jaw (two parts connected to each other). It is a concept wherein a change made in the stomatognathic system using a device taller than the normal splint will be extended to the area near the head and neck area and the central nervous system. By using an intraoral device by themselves, patients need not be hospitalized, and pressure on the cervical vertebrae can be reduced by using it for hours per day during a certain period.

Though some researchers doubt this theory, many researchers reported mandibular movement and coordination exercise of the cervical vertebrae after analyzing the functional movement of muscles or reflection of nerves. Based on these reports, considering that fact that mandibular movement and coordination exercise of the cervical vertebrae are connected functionally, the use of an intraoral device designed to increase the vertical diameter is...

assumed to increase the masticatory muscles related to mandibular movement, relax the neck muscles connected to the lower jaw, and consequently relieve muscle pain and tension-type pain caused by the contraction of the surrounding muscles\textsuperscript{14-16}. This report also assumed that the increase of masticatory muscle leads to the relaxation of muscles in the head and neck area based on the treatment result of neck pain and shoulder pain. In addition, most cases wherein the template was applied had a symptom that progressed, but the treatment result of temporomandibular disorder was good.

Harmful stimulation in the cervical portion is delivered to the trigeminal subnucleus caudalis not only through the trigeminal nerve but also via various nerves (Fig. 5). In other words, headache as one of the head and neck area pains passes the caudate nucleus of the trigeminal subnucleus caudalis regardless of its cause (Fig. 6)\textsuperscript{22-24}.

By using an intraoral device to increase the vertical diameter, masticatory muscles for mandibular movement are increased and stretched. As a

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**Fig. 4.** Quadrant theorem for head and neck area movement as suggested by Dr. Guzay: based on the physical analysis of mandibular and neck movement (Quadrant theorem: Physical analysis theory on mandibular movement. Narae Publishing, 2011, Seoul).

**Fig. 5.** Harmful receiving area of spinal trigeminal nucleus. Between brackets are nerves that deliver pain. V: 5th cranial nerve, IX: 9th cranial nerve, X: 10th cranial nerve, C: cervical nerve.
result, the conduction of proprioceptive sense of muscle spindles in the masticatory muscle stimulates trigeminal nucleus neurons in the brain stem’s midbrain. The direct delivery of muscle spindles’ signal in the brain and the existence of masticatory muscles’ motor circuit are clinically significant (Fig. 7). In short, signals delivered to trigeminal nucleus neurons not only form a circuit with the trigeminal motor nucleus and participate in masticatory movement but also connect with the lateral medullary reticular formation, VI lamella of the C1–C3 spinal segment, Supra- and juxtagenic regions, and cerebellum. In addition, because signals of muscle spindles reportedly affect trigeminal thalamic fibers, the starching of masticatory muscle can be assumed to change the delivery process of pain. There are some research studies on the relationship between the trigeminal nerve circuit and migraine. In this research, the treatment rate of headache was 88.8%, and the improvement rate of VAS for headache severer than the medium level was 80%. Therefore, since the template treatment used in this research is a conservative method rather than surgery or medication, it can be a treatment for chronic headache based on more research and analyses. In addition, the basis of the suppression mechanism of other pains is the connection between the trigeminal nerve and nucleus locus ceruleus, and trigeminal nerve has the biggest and most extensive connectivity in the brain stem; hence the need for more research on the trigeminal nerve.
Conclusion

The result of this study will contribute to understanding the symptoms of patients more clearly based on neurophysiological evaluation and analysis of patients of head and neck area pain. Managing patients’ symptom with various methods based on such evaluation will increase the efficiency of treatment and broaden its range; hence the need to pay more attention to the role and function of trigeminal nerve and conduct the relevant research. So, we suggest the template appliance can be attempted for cases whose headache, the neck and the shoulder muscle pain and TMD are not resolved with various conventional treatment methods. We see the need to analyze complex factors and conduct in-depth research by reviewing papers and clinical results and a relationship between posture and stomatognathic system.

References

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Appendix. Academy for Medical and Dental Co-operation Questionnaire

<table>
<thead>
<tr>
<th>신체상태(A)</th>
<th>신체상태(B)</th>
<th>정신상태(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 몸에 긴장감 있어요.</td>
<td>30. 눈 끼고 잠을 자요.</td>
<td>60. 혼란, 난처해요.</td>
</tr>
<tr>
<td>2. 부상이 회복되고 있어요.</td>
<td>31. 신경이 동작하지 않아요.</td>
<td>61. 혼란, 난처해요.</td>
</tr>
<tr>
<td>3. 당뇨병이 체중감소해요.</td>
<td>32. 어색해요.</td>
<td>62. 부정성, 불안해요.</td>
</tr>
<tr>
<td>4. 혈압이 상승해요.</td>
<td>33. 결석과 피로감.</td>
<td>63. 부정성, 불안해요.</td>
</tr>
<tr>
<td>5. 저혈압이 고혈압이 되어요.</td>
<td>34. 무기력하고 피곤해요.</td>
<td>64. 부정성, 불안해요.</td>
</tr>
<tr>
<td>6. 심장질환이 있답니다.</td>
<td>35. 피로하고 둥근다.</td>
<td>65. 부정성, 불안해요.</td>
</tr>
<tr>
<td>7. 인지기능이 저하되어요.</td>
<td>36. 의사소통이 어려워요.</td>
<td>66. 부정성, 불안해요.</td>
</tr>
<tr>
<td>8. 허리통증이 있어요.</td>
<td>37. 열린 장애가 있어요.</td>
<td>67. 부정성, 불안해요.</td>
</tr>
<tr>
<td>9. 부인이 필요해요.</td>
<td>38. 문화적 차이가 있어요.</td>
<td>68. 부정성, 불안해요.</td>
</tr>
<tr>
<td>10. 하루하루가 힘들어요.</td>
<td>39. 정신적 스트레스가 있어요.</td>
<td>69. 부정성, 불안해요.</td>
</tr>
<tr>
<td>11. 노래태에 해요.</td>
<td>40. 긴장감이 없어요.</td>
<td>70. 부정성, 불안해요.</td>
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