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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

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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[2].

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).

Fig. 1. Photograph of template installed in the mouth.

Table 1. Classification with symptoms

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

TMD: symptoms of temporomadibular 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.

Table 2. Improvement's rates of symptoms

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

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

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

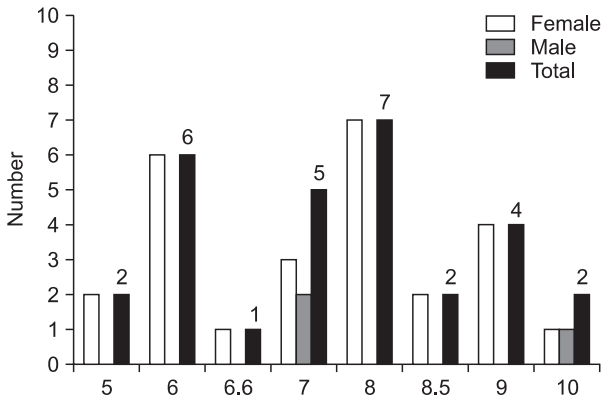

Fig. 2. Headache patients numbers before template therapy with VAS (n=29). VAS: visual analogue scale.

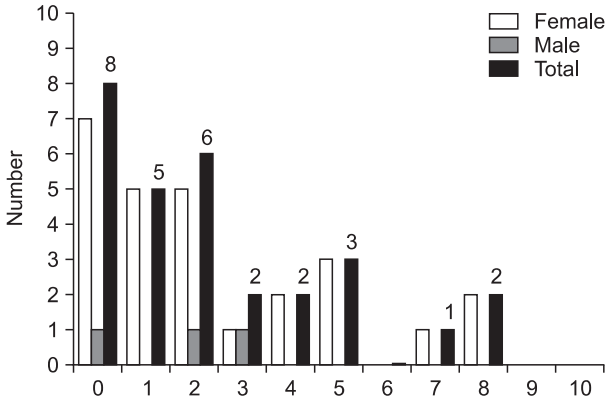

Fig. 3. Headache patients numbers after template therapy with VAS (n=29). VAS: visual analogue scale.

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[5] 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 centripetal nerve fibers occur in the occipital region, forehead, and orbital region[11]. 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[12].

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[13]. 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[14,15]. 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[16]. 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[17-21]. 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[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)[22-24].

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

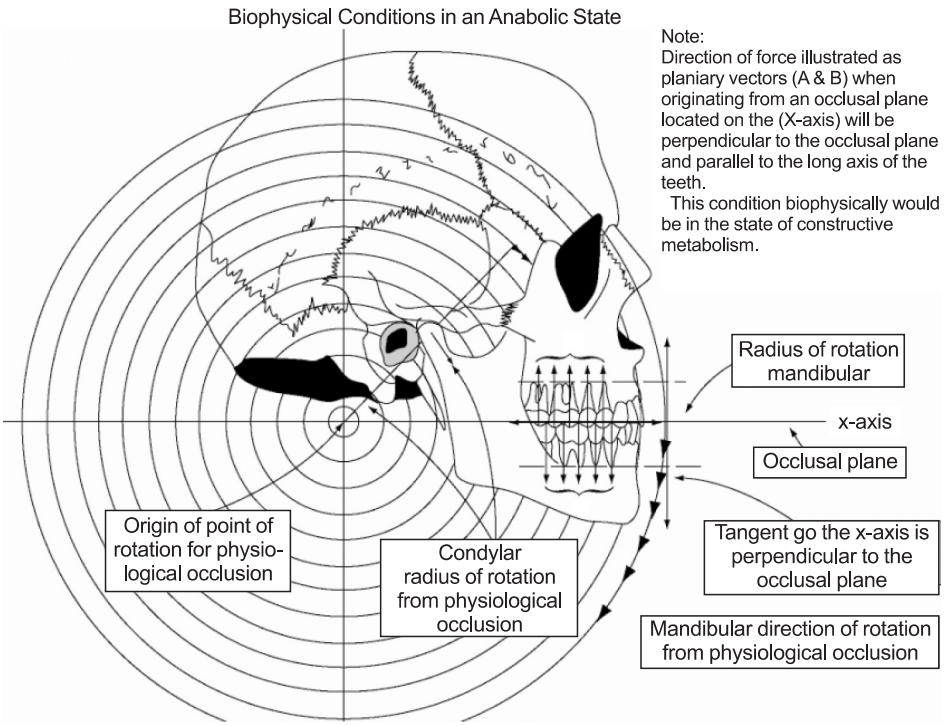

Fig. 4. Quadrant theorem for head and neck area movement as suggested by Dr. Guzay: based on the physical analysis of mandibular and neck movement (Quadrant theorem: Physical analysis theory on mandibular movement. Narae Publishing, 2011, Seoul).

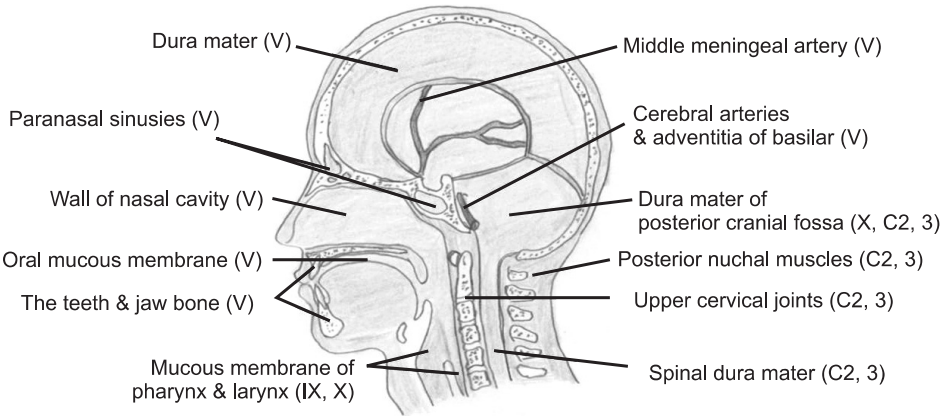

Fig. 5. Harmful receiving area of spinal trigeminal nucleus. Between brackets are nerves that deliver pain. V: 5th cranial nerve, IX: 9th cranial nerve, X: 10th cranial nerve, C: cervical nerve.

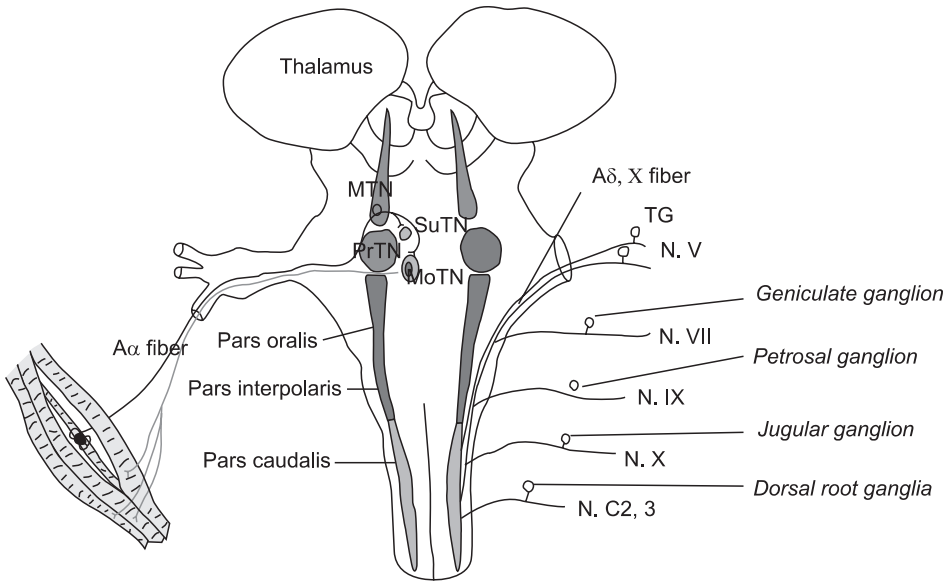

Fig. 6. Spinal trigeminal nucleus consists of pars oralis, pars interpolaris, and pars caudalis. Nociceptive sense is delivered to pars caudalis. MTN: mesencephalic trigeminal nucleus, SuTN: supratrigeminal nucleus, PrTN: trigeminal pontine nucleus, MoTN: trigeminal motor nucleus, TG: trigeminal ganglion, N.: nerve.

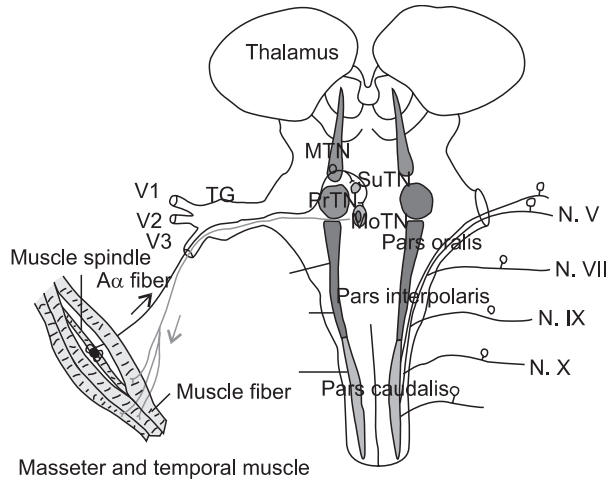

Fig. 7. Circuit diagram of the delivery process from the muscle spindle of the masticatory muscle to the mesencephalic trigeminal nucleus and trigeminal motor nucleus. MTN: mesencephalic trigeminal nucleus, SuTN: supratrigeminal nucleus, PrTN: trigeminal pontine nucleus, MoTN: trigeminal motor nucleus, TG: trigeminal ganglion. N.: nerve.

result, the conduction of proprioceptive sense of muscle spindles in the masticatory muscle stimulates trigeminal nucleus neurons in the brain stem's midbrain[23-25]. The direct delivery of muscle spindles' signal in the brain and the existence of masticatory muscles' motor circuit are clinically significant (Fig. 7)[25]. 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-, Inter-, juxtatrigeminal regions, and cerebellum[25]. In addition, because signals of muscle spindles reportedly affect trigeminal thalamic fibers[26], 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[27,28]. 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[29,30], 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.

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Appendix. Academy for Medical and Dental Co-operation Questionnaire

신체상태(A)	매우심함	심함	보통	없다
1. 몸의 상태가 몹시 나쁘다.				
2. 쉽게 피로하다.				
3. 그냥 몸이 피로하다.				
4. 아침에도 피곤함이 남아 있다.				
5. 힘이 빠져나감을 느낀다.				
6. 머리가 띵하다.(허탈감)				
7. 머리가 흔들린다.				
8. 머리가 어지럽다.				
9. 머리가 아프다.				
10. 머리가 무겁다.				
11. 눈앞이 캄캄하다.				
12. 눈이 부시다.				
13. 귀에서 소리가 울린다.				
14. 소리에 민감해져 당황스럽다.				
15. 몸에 열기가 있다.				
16. 정신이 멍할 때가 있다.				
17. 실신 할 때가 있다.				
18. 경기를 일으킬 때가 있다.				
19. 어깨와 목이 결린다.				
20. 다리가 무겁다.				
21. 가슴이 답답하다.				
22. 다리가 흔들린다.				
23. 땀이 잘 안 나온다.				
24. 허리를 자유롭게 움직일 수가 없다.				
25. 손이 떨린다.				
26. 몸이 떨린다.				
27. 근육이나 관절이 뻐근하다.				
28. 팔이나 다리에 신경통증을 느낀다.				
29. 관절이 자주 아프다.				
30. 일을 계속 못할 정도로 등과 허리가 아프다.				
31. 심장박동소리가 느껴진다.				
32. 심박이 대단히 가파르다.				
33. 호흡이 곤란해질 때가 있다.				
34. 호흡이 끊어질 때가 잦다.				
35. 가슴이나 심장이 조여 듦을 느낀다.				
36. 가슴이나 심장이 눌림을 느낀다.				
37. 손발이 저리다.				
38. 손발 끝이 보라색을 띤다.				
39. 메스꺼움을 느낀다.				
40. 구토를 한다.				
41. 속이 답답하다.				
42. 설사를 한다.				
43. 변비증상을 느낀다.				
44. 식욕이 없다.				
45. 혀가 따갑다.				
46. 살이 빠진다.				
47. 복통을 느낀다.				
48. 소변이 잦아 불편하다.				
49. 소변이 적어 불편하다.				
50. (성인)성욕이 강해진다.				
51. (성인)성욕이 떨어진다.				
52. (여성)생리통으로 고통스럽다.				
53. (여성)생리불순이다.				
54. 입이 마르다.				
55. 식은땀이 흐른다.				
56. 땀을 잘 흘린다.				
57. 열이 난다.				
58. 피부가 두드러기가 난다.				
59. 피부가 거칠다.				
60. 피부가 가렵다.				
61. 쉽게 잠들지 못한다.				
62. 깊게 잠들지 못한다.				
63. 밤에 자주 눈이 떠진다.				
64. 꿈을 많이 꾼다.				
65. 새벽에 눈이 떠진다.				
66. 졸림을 느낀다.				

정신상태(B)	매우심함	심함	보통	없다
67. 기분이 급격히 변한다.				
68. 기분이 쉽게 변한다.				
69. 여러 일에 신경이 예민해진다.				
70. 안절부절 못한다.				
71. 왠지 불안하다.				
72. 주변 일에 귀찮음을 느낀다.				
73. 긴장감을 강하게 느낀다.				
74. 사람과의 관계가 불편하다.				
75. 쉽게 눈물이 난다.				
76. 신경질적이 되어 가만히 못 있는다.				
77. 신경쇠약이 있다.				
78. 가만히 있지를 못한다.				
79. 신경질적으로 된다.				
80. 쉽게 화를 낸다.				
81. 감정이 무뎌진다.				
82. 공포감을 느낀다.				
83. 사람과의 만남이 무섭다.				
84. 신경이 산란하다.				
85. 쉽게 싫증을 느낀다.				
86. 주의력이 떨어진다.				
87. 집중력이 떨어진다.				
88. 쉽게 잊어버린다.				
89. 판단력이 흐려진다.				
90. 결단력이 흐려진다.				
91. 결단을 내리지 못한다.				
92. 활기가 없다.				
93. 의욕이 없다.				
94. 주변 일에 흥미가 없다.				
95. 어떤 일에도 흥미가 없다.				
96. 당혹감을 느낀다.				
97. 마음이 무겁다.				
98. 기분의 고조를 느낀다.				
99. 기분이 너무 좋다.				
100. 턱관절이 뻐근하고 소리가 난다.				
101. 늘 입이 아프다.				
102. 혀가 아프다.				
103. 얼굴(안면)에 통증을 느낀다.				
104. 광대뼈가 저리다.				
105. 이가 나빠 불편하다.				
106. 난청이 있다.				
107. 치아교정을 한적이 있다.				
108. 템플레이트를 장착하지 않으면 불안해진다.				