

Does the Pain Associated with Temporomandibular Disorder Increase on Rainy Days?

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Purpose: Patients who suffer from rheumatic arthritis, fibromyalgia, other various inflammatory diseases and musculoskeletal disorders, which are all similar to temporomandibular disorders (TMD), have been complaining about changes in the level and type of pain in response to changes in weather conditions for a long time. Through an investigation about pain perception in TMD patients in response to weather conditions, our primary objective was to develop base materials for future studies on change in pain in response to meteorological factors.

Methods: Among patients who presented with TMD to Department of Oral Medicine, Pusan National University Dental Hospital from August to October 2016, one hundred consecutive TMD patients diagnosed with TMDs according to Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were recruited for the study and 28 patients were excluded according to exclusion criteria. Survey was done with the questionnaire and investigated whether there was any difference in incidence and level of pain in TMD patients between non-rainy and rainy days.

Results: Among a total of 72 samples, 4 patients reported change in pain on rainy days rather than non-rainy days. Two patients from chronic group (joint and complex subgroup) reported increased pain on rainy days rather than non-rainy days but it was not statistically significant ($p>0.05$). One patient from chronic/muscle group reported the change in pain characteristics while pain intensity remained unchanged. One patient from acute/complex group reported decreased pain intensity. In comparison of the patients who reported increased pain on rainy days between acute and chronic groups, there were two reported cases and were both from chronic group only. There was a significantly higher chance of reporting increased pain on rainy days in chronic group than acute group ($p<0.001$).

Conclusions: It is considered that TMD patients couldn't perceive the change in pain well in response to weather change on rainy days but some chronic patients could perceive the increase in pain in rainy days.

Key Words: Facial pain; Meteorological concepts; Rain; Temporomandibular joint disorders; Weather

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INTRODUCTION

Temporomandibular disorder (TMD) is a condition resulting from a physiological imbalance. It is characterized by

pain and dysfunction of the temporomandibular joint (TMJ) caused by pressure arising from parafunctional activities such as excessive chewing, talking, bruxing and clenching. The pressure leads to ischemia and inflammation of the

TMJ and surrounding tissues.^{1,2)} Patients with rheumatic arthritis (RA), fibromyalgia, other various inflammatory diseases and musculoskeletal disorders, which are all similar to TMDs, have been complaining about changes in the level and type of pain in response to changes in weather conditions for a long time.²⁻¹⁰⁾ Accordingly, several studies have demonstrated the effects of atmospheric pressure on osteoarthritis (OA), pain and inflammation.

Reports showing a definite trend of low prevalence rates of RA in high atmospheric pressure regions give credence to the notion that atmospheric pressure affects OA, either directly or indirectly.¹¹⁾ When atmospheric pressure increases, the concentration of dissolved oxygen in tissue increases and this promotes angiogenesis, reduces edema and inflammation. Therefore, it is assumed to be a mechanism influencing recovery from OA.^{12,13)} Conversely, it is assumed that the opposite reaction to the above would occur in regions of low atmospheric pressure or during times when the atmospheric pressure is low, such as a rainy day.

Guedj and Weinberger⁶⁾ reported that 4/16 patients (25.0%) with RA and 20/24 patients (83.3%) with OA showed changed arthritic symptoms that corresponded with changes in weather. Sato et al.³⁾ suggested that chronic pain was aggravated by vasoconstriction and ischemia induced by sympathetic activation under a lower barometric pressure environment. Edefonti et al.¹⁴⁾ studied change in pain in response to weather conditions in 7 patients affected by chronic masticatory muscle pain and suggested that chronic masticatory muscle pain may be influenced by weather change and suggested the need for further studies with larger sample sizes.

This study aimed to assess whether the pain associated TMD increase on rainy days. Through an investigation about pain perception in TMD patients in response to weather conditions, our primary objective was to make basic data for future studies on change in pain in response to meteorological factors in TMD patients and for better understanding pain characteristics of TMD patients.

MATERIALS AND METHODS

1. Study Sample

One hundred consecutive TMD patients who had visited

the Department of Oral Medicine, Pusan National University Dental Hospital (Yongsan, Korea) from August to October 2016 participated in this study. The study was designed to include patients (i) diagnosed with TMJ disorders (axis I, group II, IIIa, IIIb) and/or masticatory muscle disorders (axis I, group I) according to Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) criteria. (ii) For determine chronicity, each patient was assessed about having pain for at least 6 months and still in the last month. Patients with history of TMJ surgery for the treatment of TMD, any surgery related to chronic pain excluding TMJ in recent 6 months period and presence of systemic disease causing pain were excluded. Twenty-eight patients were excluded.

Table 1 shows the composition of our participants. Their age ranged from 13 to 86 years old. A total of 72 patients participated in the study. Men were 12 patients (23.9±7.9 years old) and women were 60 patients (30.0±15.9 years old). The participants were classified into acute and chronic groups according to their chronicity of diseases, and the following subgroups: muscle, joint and complex (both muscle and joint) according to the diagnosis based on RDC/TMD.

2. Study Method

The study protocol was approved by the Institutional Review Board of Pusan National University Dental Hospital (PNUDH-2016-018).

Table 1. Demographic and clinical characteristics of the study subjects (n=72)

	No. of patients	Male (n=12)	Female (n=60)	p-value
Mean age (y)		23.9±7.9	30.0±15.9	
Pain group				>0.05
Acute	26			
Muscle	5	1	4	
Joint	14	1	13	
Both	7	1	6	
Chronic	46			
Muscle	4	1	3	
Joint	23	4	19	
Both	19	4	15	

Values are presented as mean±standard deviation or number only.

3. Statistical Analysis

The associations between categorical variables were evaluated using the chi-square test. The pairwise comparisons of the pain of groups according to weather change were analyzed with the Mann-Whitney U test using Bonferroni adjusted p-values. Results are expressed using odds ratios with their 95% confidence intervals. Statistical analyses were done using SAS software version 9.3 for Windows (SAS Institute, Cary, NC, USA). p-values of less than 0.05 were considered statistically significant.

RESULTS

Table 2 shows the number of patients who reported change in pain on rainy days compared to non-rainy days. Two patients from the chronic group, one from joint, and the other

Table 2. Number of samples who reported change in pain on rainy days compared to non-rainy days and their percentage (p>0.05)

Pain group	No. of patients	Change of pain character		
		Elevated pain	Changed pain	Lowered pain
Acute	26			
Muscle	5	0	0	0
Joint	14	0	0	0
Complex	7	0	0	1 (14.3) ^a
Chronic	46			
Muscle	4	0	1 (25.0) ^a	0
Joint	23	1 (4.3) ^{a,*}	0	0
Complex	19	1 (5.3) ^{a,*}	0	0

Values are presented as number only or number (%).

^aIndicate a change in pain characteristics.

*Significantly more patients with chronic pain reported change than who with acute pain (p<0.001).

from complex, reported increased pain on rainy days rather than ordinary days but it was not statistically significant (p>0.05). One patient from chronic/muscle group reported change in pain characteristics while pain intensity remained unchanged. One patient from acute/complex group reported decreased pain intensity.

In comparison of the patients who reported increased pain on rainy days between acute and chronic groups, there were two reported cases and both were from chronic. There was a significantly higher chance of reporting increased pain on rainy days in chronic than acute (p<0.001).

Table 3 (Appendix 1) shows the details of the patients who reported change in pain on rainy days compared to non-rainy days. One out of the 26 acute group patients (case 4) reported decreased pain on rainy days rather than non-rainy days (visual analogue scale [VAS] 3→2); however, the pain persisted for longer on rainy days. The patient also reported that the type of pain changed from an aching pain on non-rainy days to a tight, pressing pain on rainy days. Activities such as deep thoughts caused pain on non-rainy days but on rainy days, it was triggered before and after eating.

Three out of the 46 patients in chronic group (cases 1, 2, and 3) perceived change in pain characteristics. Two of these patients (cases 1 and 2) reported an increase in pain on rainy days. One patient was from the joint subgroup and the other from complex subgroup. Both patients reported an increase in pain intensity by 2 points on the VAS.

Case number 2 patient from joint group reported an increase in pain duration from a few minutes on non-rainy days to over 1/2 a day until sleep on rainy days. The type

Table 3. Sex, age, diagnosis, and pain characteristics of the patients who reported change in pain on rainy days compared to non-rainy days

Change of pain character	Case No.	Sex	Age (y)	Subgroup of TMD diagnosis (according to RDC/TMD)	Non-rainy days question No.							Rainy days question No.								
					1							2								
					a)	b)	c)	d)	e)	f)	g)	a)	b)	c)	d)	e)	f)	g)		
Elevated	1	F	26	Complex	1 ^a	4	2 ^a	3 ^a	1 ^a	3	1	1 ^a	3 ^a	4	1 ^a	4 ^a	6 ^a	3	1	2 ^a
	2	F	26	Joint	2 ^a	4	1 ^a	2 ^a	6	3	1 ^a	1	4 ^a	4	3 ^a	5 ^a	6	3	2 ^a	1
Changed pattern	3	M	22	Muscle	3	4 ^a	2 ^a	1	6	3, 4, 5	1, 2	2	3	1 ^a	1 ^a , 2 ^a	1	6	3, 4, 5	1, 2	2
Lowered	4	M	28	Complex	3 ^a	2 ^a	1	2 ^a	6	6 ^a	1 ^a	2	2 ^a	3 ^a	1	6 ^a	6	1 ^a	2 ^a	2

TMD, temporomandibular disorder; RDC/TMD, Research Diagnostic Criteria for Temporomandibular Disorders; F, female; M, male.

Refer to Appendix 1 for the question numbers.

^aIndicate a change in pain characteristics.

of pain changed from an aching pain to a tight, pressing pain on rainy days.

Case number 1 patient from complex group reported a change in pain location from the lower jaw on non-rainy days to the area in front of the ear on rainy days. Pain duration increased from a period between a few seconds and one hour to less than half a day on rainy days. Pain could be controlled after taking medication on non-rainy days but pain persisted after taking medication on rainy days.

Case number 3 patient was one of the three chronic group patients who perceived change in pain characteristics. The patient reported no change in pain intensity, only a change in pain characteristics. This patient was included in the muscle subgroup having suffered TMD for more than a year but only experiencing pain on rainy days for less than 3 months. The patient only had lower jaw pain on non-rainy days but also perceived additional pain in the area in front of the ear during rainy days.

DISCUSSION

There have been a few studies on change in pain experienced by patients in response to changes in weather and temperature.^{8,15-23)} Change in atmospheric pressure and temperature reduction have been reported to result in peripheral vasoconstriction, local increase in inflammation cells and adrenaline, with a decrease in the sensory threshold of central and peripheral nociceptive fibers. A key objective of this study was to investigate how weather conditions affect the quality of life of TMD patients and whether the patients perceive this discomfort or not.

When comparing pain perception of the participants on non-rainy days versus rainy days, there was no significant difference shown in both acute and chronic groups ($p>0.05$). Among 72 patients, only 4 cases perceived the change in pain characteristics on rainy days and only two cases reported an increase in pain intensity.

Only one out of the 26 acute group patients (case 4) reported decreased pain intensity on rainy days compared to non-rainy days (VAS 3→2) but the patient complained about the pain persisted for longer on rainy days and the type of pain changed from an aching pain on non-rainy days to a tight, pressing pain on rainy days, showing

decreased pain intensity but longer pain duration on rainy days. Furthermore deep thoughts like worries caused pain on non-rainy day but daily life activities like eating triggered pain on rainy days, showing increased frequency of pain on rainy days.

Three out of the 46 patients in chronic group (cases 1, 2, and 3) perceived change in pain characteristics and out of these two patients (cases 1 and 2) reported an increase in pain on rainy days. Two patients who reported increased pain intensity were one from the joint subgroup and the other from complex subgroup. These patients reported an increase in pain intensity by 2 points on VAS and were both 26 years old females. Both cases reported longer pain duration on rainy days. The patient (case 1) from Complex subgroup showed persisted pain after taking medication on rainy days, which is unusual compared to non-rainy days.

Case number 2 patient from chronic/joint group and case number 4 patient from acute/complex group perceived an aching pain on non-rainy days but a tight, pressing pain in rainy days. Case number 1 patient from chronic/complex group and case number 3 patient from chronic/muscle group perceived pain in lower jaw area on non-rainy days but perceived increased pain in TMJ area on rainy days. It is considered to be that joint area is more sensitive to pain on rainy days. Case number 3 patient from chronic/muscle group, suffering from TMD for more than a year, started to feel pain on rainy days for less than three months and case number 2 patient from chronic/joint group reported headache occurred only on rainy days. Our results matches with the study that migraine or tension-type headache increased due to decrease in atmospheric pressure.¹⁹⁻²¹⁾

Edefonti et al.¹⁴⁾ investigated and analyzed change in pain perception in response to weather conditions in patients affected by chronic masticatory muscle pain and suggested that chronic masticatory muscle pain may be influenced by weather changes although there were different individual responses. The subjects in this study were chronic masticatory muscle patients. However the results of our study showed that TMD patients who reported change in pain perception due to changes in weather were only a few but joint pain was considered to be more sensitive to changes in weather like raining.

To date, patients suffering the following diseases: OA in

other joints, rheumatoid arthritis,^{3,5-10)} fibromyalgia, low back pain, migraine, tension-type headaches^{8,15-23)} have demonstrated greater sensitivity to changes in weather with respect to pain intensity and characteristics. The patients with these diseases show more severe pain and difficulty in daily living than average TMD patients. In contrast, a TMD patient who does not have any other systemic disease shows relatively less pain in localized areas. For this reason, the assumption can be made that the rate of pain increase on rainy days was not high in our study. TMD occurs more frequently in younger age groups whereas other chronic systemic diseases occur in older patients so this could also be one of the causative factors.

The sample size was too small to analyze aspects of patients who reported both an increase in pain intensity and changes in pain characteristics on rainy days. Therefore, further studies are needed with larger sample sizes.

It seems that TMD patients couldn't perceive the change in pain well in response to weather change on rainy days. However, some chronic patients are estimated to experience an increase in pain (in the frequency of approximately 4.3%) in rainy days.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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Appendix 1. Questionnaire.• **Questionnaire****I. Questions about pain that you feel during non-rainy days.**

1. Circle the number corresponding to pain that you feel on non-rainy days:

0	1	2	3	4	5	6	7	8	9	10	
no pain-----able to live daily life with discomfort-----difficulty in daily life-----impossible to live daily life-----worst possible pain											
☺								☹			☹

2. Read the questions and circle the number corresponding to your response(s) to each question (Circle all that apply.):

a) How long have you been feeling this pain?

- ① Less than 3 months
- ② 3-6 months
- ③ 6 months-1 year
- ④ Over 1 year

b) The area where you feel pain?

- ① In front of your ear
- ② Lower jaw
- ③ Head
- ④ Other

c) How long does your pain persist?

- ① For a few seconds
- ② For a few minutes
- ③ 30 minutes-1 hour
- ④ 1 hour-less than half a day
- ⑤ Over half a day-until sleep
- ⑥ Over one day

d) What time of a day do you feel pain?

- ① From right after wake-up until 10 am
- ② 10 am-2 pm
- ③ 2 pm-6 pm
- ④ 6 pm-10 pm
- ⑤ 10 pm-before sleep
- ⑥ No special time period

e) Which of the following activities cause your pain?

- ① During or after eating
- ② After talking a lot
- ③ When you concentrate
- ④ During physical activities (lifting heavy objects, exercise)
- ⑤ During deep thoughts like worry

f) What does your pain feel like?

- ① Aching pain
- ② Tight, pressing pain
- ③ Pulsing pain
- ④ Electrical pain
- ⑤ Burning pain

g) Does your pain still exist after taking medication?

- ① No
- ② A little bit
- ③ Yes

II. Questions about pain that you feel on rainy days.

1. Circle the number corresponding to pain that you feel on rainy days:

0	1	2	3	4	5	6	7	8	9	10
no pain-----able to live daily life with discomfort-----difficulty in daily life-----impossible to live daily life-----worst possible pain										
😊			😐				☹️			

2. Read the questions and circle the number corresponding to your response(s) to each question (Circle all that apply.):

a) How long have you been feeling pain on rainy days?

- ① Less than 3 months
- ② 3-6 months
- ③ 6 months-1 year
- ④ Over 1 year

b) The area where you feel pain?

- ① In front of your ear
- ② Lower jaw
- ③ Head
- ④ Other

c) How long does your pain persist?

- ① For a few seconds
- ② For a few minutes
- ③ 30 minutes-1 hour
- ④ 1 hour-less than half a day
- ⑤ Over half a day-until sleep
- ⑥ Over one day

d) What time of a day do you feel pain?

- ① From right after wake-up until 10 am
- ② 10 am-2 pm
- ③ 2 pm-6 pm
- ④ 6 pm-10 pm
- ⑤ 10 pm-before sleep
- ⑥ No special time period

e) Which of the following activities cause your pain?

- ① During or after eating
- ② After talking a lot
- ③ When you concentrate
- ④ During physical activities (lifting heavy objects, exercise)
- ⑤ During deep thoughts like worry

f) What does your pain feel like?

- ① Aching pain
- ② Tight, pressing pain
- ③ Pulsing pain
- ④ Electrical pain
- ⑤ Burning pain

g) Does your pain still exist after taking medication on rainy days?

- ① No
- ② A little bit
- ③ Yes