

## Effect of Masticatory Muscle Pain Control by Morphine

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This study was designed to evaluate the pain control effect by morphine injection to masticatory muscle pain patients. Patients with masticatory muscle pain visited the Department of Oral Medicine, Kyung Hee University Dental Hospital were recruited to this study and diagnosed by RDC/TMD. Experimental group were divided into three group; saline injection group(n=10), lidocaine injection group(n=10) and morphine injection group(n=10). Evaluation list was the subjective pain evaluation(visual analogue scale, Mc Gill pain questionnaire, pain drawing) and the objective pain evaluation(pressure pain threshold, pressure pain tolerance) and evaluation time was injection before, after 10min, 30min, 60min and then it was analyzed statistically.

The results were as follows :

1. The subjective pain evaluation and the objective pain evaluation were significantly different statistically in within subject effects( $p<0.001$ ).
2. The subjective pain drawing evaluation( $p<0.001$ ) were significantly different statistically in between subject effects.
3. The objective pressure pain threshold evaluation( $p=0.025$ ) were significantly different statistically in between subject effects.
4. The morphine injection group( $p=0.001$ ) were more significantly different than the saline injection group statistically in the subject pain drawing evaluation.

Therefore, it was considered that the morphine injection was effective to pain control for masticatory muscle pain patients within 60 minute.

**Key words:** Masticatory Muscle Pain, Morphine sulfate, Temporomandibular Disorders

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### I. INTRODUCTION

Pains are perceived, after activation of first afferent nerves by peripheral stimulations generate electrical impulses that transmitted to central nervous system through serial neuro-pathway. Pain developing stimulations, such as tissue damages or inflammation, release pain neurotransmitters. These neurotransmitters activate receptors located on cell membrane, which cause excitatory action potential. Eventually, because activation of peripheral pain

receptors initiate pain pathway, peripheral pain receptors play an important role. Thus, wide and varied studies on peripheral tissue are underway so as to regulate pain by peripheral pain receptors.

A typical drug of pain control and analgesic effect is opioid. Opioids are still the most powerful drugs for severe pain but their use is hampered by side effects such as respiratory depression, nausea, constipation, addiction and tolerance.<sup>1)</sup> But after discovering peripherally acting opioid agonist, we expect peripheral analgesic effect of opioid without central side effects.<sup>1-3)</sup> Opioid receptor synthesized at dorsal root ganglion and migrated along the neuronal axon to peripheral and central nerve terminal.<sup>4-6)</sup> It has an analgesic effect on post-operation pain or chronic pain.<sup>7)</sup>

Especially peripheral analgesic effect is very effective under inflammatory state.<sup>8)</sup> There are studies of applying opioid when oral surgery so it can reduce post operation pain,<sup>9)</sup> and 5 mg, 10 mg morphine sulfate were applied in TMJ due to reduce pain.<sup>10)</sup> As a result, this study was designed to evaluate the pain control effect by morphine sulfate injection to masticatory muscle pain patients.

## II. SUBJECTS AND METHODS

### 1. Subjects

The subjects participated in this study were volunteers among outpatients of Department of Oral medicine, Kyung Hee University Dental Hospital during the period from August to November 2010. This study was conducted in Department of Oral medicine, Kyung Hee University Dental Hospital after receiving approval from Institutional review board of Kyung Hee University Dental Hospital. The participants were informed about the details of this experiment and signed the consent paper after reading it. And all the participants are limited that Visual Analog Scale(VAS) is over 50 and age between 20 to 55 who are diagnosed to Axis I:Group Ia Myofascial Pain by Research Diagnostic

Criteria for Temporomandibular Disorders(RDC/TMD). The subjects were excluded who had systemic musculoskeletal pain, systemic arthritis, malignant tumor, hypertension, diabetes mellitus, cardiovascular disease and pregnant women or chronic analgesic or psychiatric drug user.

### 2. Methods

One researcher divided randomly the subjects into three groups 10 persons each who had diagnosed according to RDC/TMD.

Another researcher injected 0.2 ml drug with 27G subcutaneous needle and 1.0 ml disposable syringe(SOFJEC<sup>®</sup>; HWAJINMEDICAL, KOREA) into each subjects in 10 seconds, and injection point was the most painful area on unilateral masticatory muscle in palpation.

The other researcher ordered randomly the sequence of injected drugs, as a result, double blind procedure about the injected drug was done to both researcher and subjects.

Initially classified subject groups were morphine sulfate(15mg/1ml; BCworld, KOREA) 3.0 mg injection group, lidocaine HCl(2%/20 ml; Huons, KOREA) injection group and saline(NaCl 9 g/1000 ml; JWPharmaceutical, KOREA) injection group.

The subjective pain and objective pain to each drugs were evaluated at just before the injection, 10 minutes after the injection, 30 minutes after injection and 60 minutes after the injection.

### 3. Pain Evaluation

#### 1) Subjective Pain Evaluation

The methods used to evaluate subjective pain in this study were visual analogue scale(VAS test), McGill Pain Questionnaire(MGQ test) and Pain drawing(PD test).

In the VAS test, subjects were asked to mark their pain with marking pen(namepenF<sup>®</sup>, Monami, KOREA) on 100 mm straight line according to pain extent; start point of 100 mm straight line with no pain, end point with the strongest pain that could

imagine. The result was converted into numbers according to the percentage.

In MGQ method, generally used McGill Pain Questionnaire in Korean version was applied to research the patients pain according to the questionnaire. The patient's subjective pain was digitalized and the data of the questionnaire was calculated by average of total score.

Lastly, the PD, subjective pain evaluation method, was a method that let the patients mark their pain area themselves with marking pen. The marking area was squared, then marking squares were counted, scored and converted to percentage.

## 2) Objective Pain Evaluation

The methods used to evaluate objective pain were pressure pain threshold(PPT) test and pressure pain tolerance(PPTol) test.

The PPT test used in this study was to estimate the pressure pain threshold around the most painful masticatory area before and after the injection with pressure pain measuring instrument(Wagner Instruments, Greenwich CT, USA), then converted into numbers.

Also PPTol was applied same area and used same pressure pain measuring instrument to calculate the pain limit of same pressure and converted into numbers.

We keep the patient's masticatory system as relaxed position as possible without tooth contact to use the pressure pain measuring instrument. The pressure was applied to muscle vertically with 11mm diameter probe by 30kPa/s velocity, the measured kgf value was divided by area of the probe and converted to kPa value. The subjects were asked to rise their left hand at the moment they felt the first pain and intolerable pain, then the values were recorded and calculated for the PPT and PPTol.

## 4. Statistical Analysis

The results from three subjective pain evaluation tests and two objective pain evaluation tests were

done the repeated measures ANOVA test using descriptive statistics and Greenhouse-Geisser method. At first, we verified the effects through within subject effects, between subject effects and interaction effects. When there were effects, we tried Post Hoc through multiple comparisons using Tukey HSD method. Every statistics significance level was  $p < 0.05$  and study scores were analyzed with PASW Statistics(SPSS version 18.0).

## III. RESULTS

### 1. Descriptive statistics result

The subjects consisted of 16 males and 14 females, total 30 people and age range was 20 to 52years, average age was  $29.4 \pm 4.5$  years. Before the injection group average was  $62.3 \pm 4.34$ , 10min after the injection group average was  $57.9 \pm 10.91$ , 30 min after the injection group average was  $54 \pm 14.17$ , 60min after the injection group was  $47.0 \pm 17.37$ . The average and the standard deviation of time line group was in Table 1.

### 2. Subjective Pain Evaluation Result

The results of VAS test as a subjective pain evaluation method show that morphine injection group decreased the most with time, followed by lidocaine injection group, but the saline injection group had little changed. Especially, these tendencies was prominent from 10 minutes after the injection to 30 minutes, and in 60 minutes after the injection, the differences between groups were lasted.(Fig. 1)

The results of MGQ test which is questionnaire-styled subjective pain evaluation method show that morphine injection group decreased steeply the most with time, lidocaine injection group decreased obviously after 10 minutes, but saline injection group had little changed.(Fig. 2)

The results of PD test that let the patients mark their pain area themselves as a subjective pain evaluation method show similar pattern in morphine

**Table 1.** The results of descriptive statistics data by PASW Statistics

	Type	Mean	SD	N
Before	LIDO	62.3000	4.32178	10
	MOR	65.0000	.00000	10
	SALINE	59.7000	5.14350	10
	Sum	62.3333	4.34172	30
After10min	LIDO	55.6000	5.05964	10
	MOR	59.8000	18.18302	10
	SALINE	58.4000	4.19524	10
	Sum	57.9333	10.91640	30
After30min	LIDO	55.3000	7.48406	10
	MOR	48.5000	22.88255	10
	SALINE	58.2000	3.48967	10
	Sum	54.0000	14.16893	30
After60min	LIDO	49.1000	5.87745	10
	MOR	38.3000	26.98580	10
	SALINE	56.5000	4.85913	10
	Sum	47.9667	17.37315	30

SD; standard deviation, LIDO; lidocaine HCl 2%/20 ml, MOR; morphine sulfate 15 mg/1 ml, SALINE; NaCl 9 g/1000 ml

**Table 2.** The results of Repeated Measures ANOVA test with Greenhouse-Geisser application by the subjective pain evaluation

	subject effects	F	df1	df2	P-value
VAS	within	16.132	1.8	48.3	0.000 *
	between	0.718	2	27	0.497
MGQ	within	14.286	1.8	48.8	0.000 *
	between	1.466	2	27	0.249
PD	within	10.939	1.9	51.8	0.000 *
	between	10.45	2	27	0.000 *

\*  $p < 0.05$ , VAS; visual analogue scale, MGQ; McGill pain questionnaire, PD; pain drawing

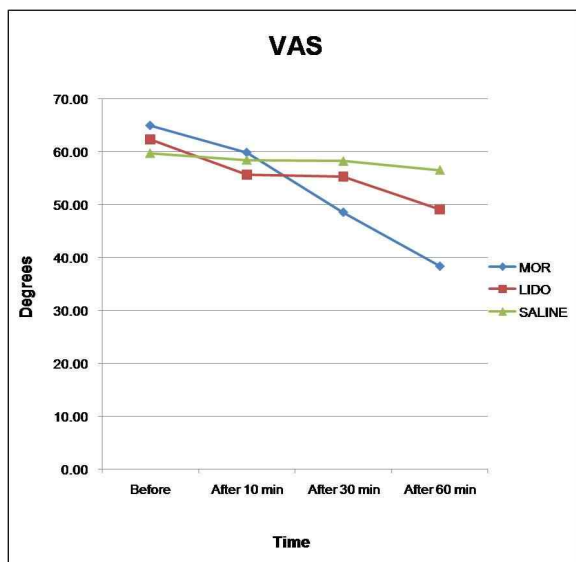


Fig. 1. The mean of VAS in every groups. MOR: morphine sulfate 15mg/1ml, LIDO: lidocaine HCl 2%/20ml, SALINE: NaCl 9g/1000ml

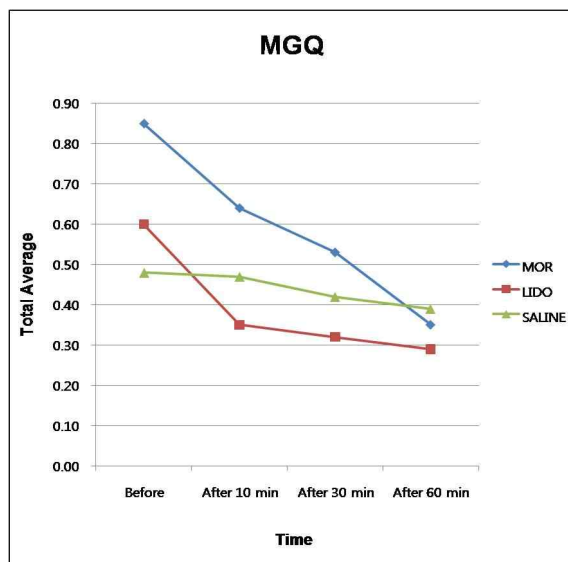


Fig. 2. The mean of total average of McGill Pain Questionnaire in every groups. MOR: morphine sulfate 15mg/1ml, LIDO: lidocaine HCl 2%/20ml, SALINE: NaCl 9g/1000ml

injection group and lidocaine injection group with time, but a quite different pattern in saline injection group. Especially, difference between saline injection group and morphine injection group, and difference between saline injection group and lidocaine injection group were remarkable.(Fig. 3)

The results of VAS test, MGQ test and PD test which are subjective pain evaluation methods were analyzed statistically, and were summarized in Table 2. The VAS( $p < 0.001$ ) and MGQ test( $p < 0.001$ ) were significantly different statistically in within the groups. PD test was significantly different statistically in within the group( $p < 0.001$ ) and between the groups( $p < 0.001$ ). As a result, VAS, MGQ and PD test, all were significantly different statistically in within subject effects, but only PD test was significantly different statistically in between subject effects.

Thus we tried Post Hoc to the PD test which was significantly different statistically in within and between subject effects, and summarized in Table 3. Inspecting for the lidocaine injection group in priority, morphine injection group was not significantly different statistically but saline

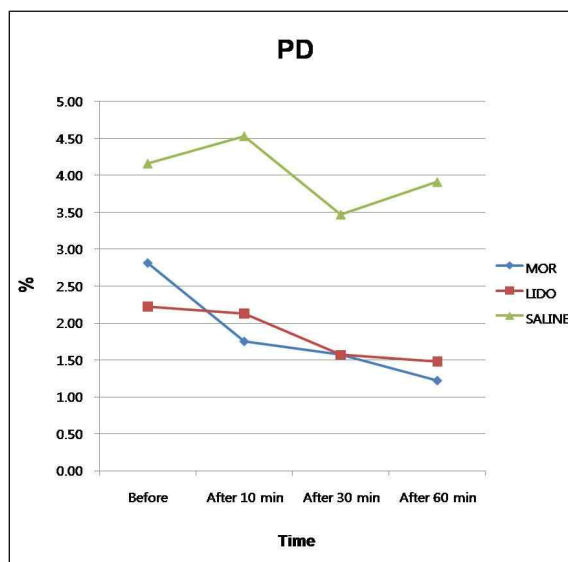


Fig. 3. The mean of percentage of Pain Drawing in every groups. MOR: morphine sulfate 15mg /1ml, LIDO: lidocaine HCl 2%/20ml, SALINE: NaCl 9g/1000ml

injection group was significantly different( $p=0.002$ ). Inspecting for morphine injection group in priority,

**Table 3.** The results of Post Hoc Multiple Comparisons by Tukey HSD for pain drawing

(I) Type	(J) Type	I-J	Std. Error	P-value	95% CI	
					Min	Max
LIDO	MOR	0.1103	0.56197	0.979	-1.2831	1.5036
	SALINE	-2.1678	0.56197	0.002 *	-3.5611	-0.7744
MOR	LIDO	-0.1103	0.56197	0.979	-1.5036	1.2831
	SALINE	-2.2780	0.56197	0.001 *	-3.6714	-0.8846
SALINE	LIDO	2.1678	0.56197	0.002 *	0.7744	3.5611
	MOR	2.2780	0.56197	0.001 *	0.8846	3.6714

\*  $p < 0.05$ , CI; confidence interval, LIDO; lidocaine HCl 2%/20ml, MOR; morphine sulfate 15mg/1ml, SALINE; NaCl 9g/1000ml

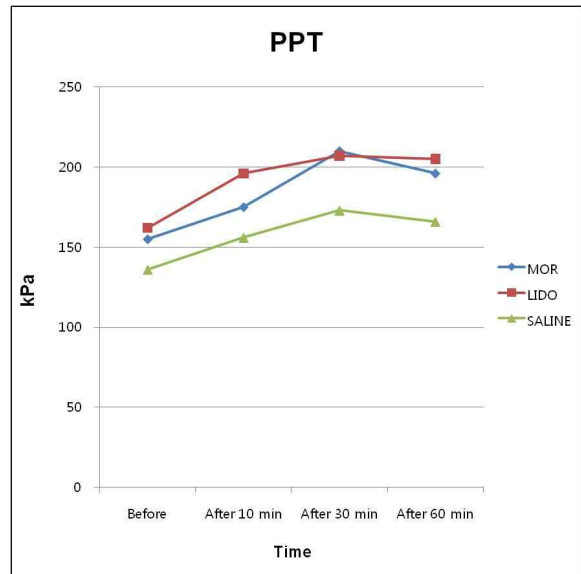
both lidocaine injection group and saline injection group were not significantly different statistically. Inspecting for the saline injection group in priority, both lidocaine injection group( $p=0.002$ ) and morphine injection group( $p=0.001$ ) were significantly different statistically.

### 3. Objective Pain Evaluation Result

The results of PPT test as a objective pain evaluation method show that morphine injection group, lidocaine injection group and saline injection group had similarly increasing tendencies with time by 30 minutes. But the saline injection group showed low threshold range compared to morphine injection group and lidocaine injection group. In lidocaine injection group and morphine injection group, partially coinciding tendencies are showed with time from 30 minutes after the injection to 60 minutes.(Fig. 4)

The PPTol test which is evaluating objective endurance to pain induced by pressure shows relatively variable tendencies with time. Slightly and consistently increased change ranges are showed in lidocaine injection group and saline injection group, but in morphine injection group, the change range is a little large with time.(Fig. 5)

The results of PPT test and PPTol test which



**Fig. 4.** The mean of pressure pain threshold, PPT in every groups. MOR: morphine sulfate 15mg /1ml, LIDO: lidocaine HCl 2%/20ml, SALINE: NaCl 9g/1000ml

are objective pain evaluation methods were analyzed statistically, and were summarized in Table 4. The PPT( $p<0.001$ ) and PPTol test( $p<0.001$ ) were significantly different statistically in within the groups. However, the PPT test was significantly different statistically in between the groups( $p=0.025$ ), too. As a result, both PPT and

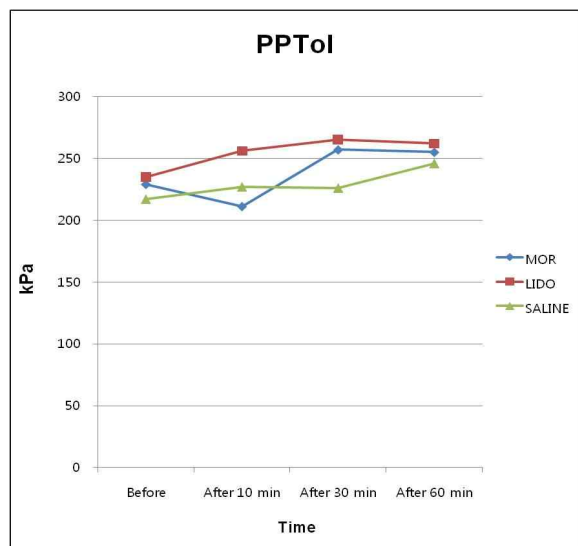


Fig. 5. The mean of pressure pain tolerance, PPTol in every groups. MOR: morphine sulfate 15mg/1ml, LIDO: lidocaine HCl 2%/20ml, SALINE: NaCl 9g/1000ml

PPTol test were significantly different statistically in within subject effects, but only PPT test was significantly different statistically in between subject effects.

Thus we tried Post Hoc to the PPT test which was significantly different statistically in within and between subject effects, and summarized in Table 5. Inspecting for the lidocaine injection group in priority, morphine injection group was not significantly different statistically but saline injection group was significantly different ( $p=0.025$ ). Inspecting for morphine injection group in priority, both lidocaine injection group and saline injection group were not significantly different statistically. Inspecting for the saline injection group in priority, lidocaine injection group was significantly different statistically ( $p=0.025$ ), but morphine injection group was not significantly different statistically.

Table 4. The results of Repeated Measures ANOVA test with Greenhouse-Geisser application by the objective pain evaluation

	subject effects	F	df1	df2	P-value
PPT	within	30.662	2.5	66.8	0.000 *
	between	4.239	2	27	0.025 *
PPTol	within	9.024	2.4	65.9	0.000 *
	between	0.953	2	27	0.398

\*  $p < 0.05$ , PPT; pressure pain threshold, PPTol; pressure pain tolerance

Table 5. The results of Post Hoc Multiple Comparisons by Tukey HSD for pressure pain threshold

(I) Type	(J) Type	I-J	Std. Error	P-value	95% CI	
					Min	Max
LIDO	MOR	8.5000	12.45254	0.776	-22.3750	39.3750
	SALINE	34.7750	12.45254	0.025 *	3.9000	65.6500
MOR	LIDO	-8.5000	12.45254	0.776	-39.3750	22.3750
	SALINE	26.2750	12.45254	0.107	-4.6000	57.1500
SALINE	LIDO	-34.7750	12.45254	0.025 *	-65.6500	-3.9000
	MOR	-26.2750	12.45254	0.107	-57.1500	4.6000

\*  $p < 0.05$ , CI; confidence interval, LIDO; lidocaine HCl 2%/20ml, MOR; morphine sulfate 15mg/1ml, SALINE; NaCl 9g/1000ml

#### IV. DISCUSSION

The glutamate which is representative pain inducing material secretes at the first afferent nerve fiber terminal, and the receptor which is located at the nociceptor terminal activates when there was a glutamate secreted by nerve cell, Schwann cell, mast cell due to tissue damage or inflammation.<sup>11-14)</sup> There are glutamate receptors which is ionic NMDAR(N-methyl D-aspartate receptor), AMPAR ( $\alpha$ -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor) and metabotropic glutamate receptors(mGluR). When the first afferent nerve fiber terminal secretes the glutamate, post synaptic nerve cell receptor senses and activated. The study of Chun et al,<sup>15)</sup> which was the influence of terminal AMPA receptor to the muscle nociceptive effect and c-fos activation proposed that GluR1 and GluR2, AMPA subunits, develops in the trigeminal ganglion neurons and masseter afferent nerve cell bodies. As a result, acute muscle pain partially mediated by AMPA receptor which is located in the terminal and when several terminal glutamate receptor subunit is blocked it might be reduce the muscle pain and central nerve activation more effectively.<sup>15)</sup> In the study of Ro et al,<sup>16)</sup> the animal model of hypertonic saline(HS) infusion protocol causes peripheral release of glutamate, and that blockade of peripheral NMDA receptors significantly reduces HS-induced nocifensive behavior and central neuronal activation.

In the study of investigating the effects of ketamine, which is antagonist of glutamate, on chronic myofascial pain and mandibular function in temporomandibular disorder patients, ketamine did not play a major role in the pathophysiology of chronic myofascial temporomandibular disorder pain. Although there was a minor effect of ketamine on maximum voluntary jaw opening, local administrating may not be promising treatment for these patients.<sup>17)</sup> If there was an increase of glutamate in intermedia, it could cause chronic pain and we can find a higher glutamate if there was a chronic non-inflammatory pain on human tendon

and muscle.<sup>18,19)</sup>

Not only glutamate but also capsaicin is known as a major pain inducing material and a powerful stimulant to capsaicin transient receptor potential cation channel, subfamily V, member 1(TRPV1). If capsaicin was injected in human masseter muscle, it induced powerful local hyperalgesia, referred pain and mechanical hypersensitivity.<sup>20-22)</sup> In animal experiment with rat masseter muscle, capsaicin caused powerful pain reaction and long lasting mechanical hyperalgesia.<sup>23-25)</sup>

Chun and Ro suggested that intramuscular capsaicin in rat masseter muscle induced significant increase of trigeminal caudalis(Vc) neuron response and that the blockade of peripherally localized mGluR5 can effectively attenuate muscular hypersensitivity.<sup>26)</sup> In the study of investigating the interaction between glutamate and capsaicin in inducing muscle pain and sensitization in humans, pain reduced more effectively when glutamate injection after capsaicin injection than glutamate injection after saline injection. These findings indicate that intramuscular administrations of glutamate and capsaicin interact and influence pain and sensitization of muscle nociceptors.<sup>27)</sup>

Opioids are still the most powerful drugs for severe pain but their use is hampered by side effects such as respiratory depression, nausea, constipation, addiction and tolerance.<sup>1)</sup> But after discovering peripheral opioid receptors, we expect peripheral analgesic effect without central side effects.<sup>1-3)</sup> Opioid peptide-containing circulating leukocytes extravasate upon activation of adhesion molecules, and corticotropin-releasing factor (CRF), chemokines or noradrenaline can elicit opioid release by activating their respective receptors on leukocytes. Exogenous opioids or endogenous opioid peptides bind to opioid receptors that are synthesized in dorsal root ganglia and transported along intra-axonal microtubules to peripheral and central terminals of sensory neurons results in antinociceptive effects.<sup>1)</sup>

Three kinds of opioid receptor such as  $\mu$ ,  $\delta$ ,  $\kappa$  - opioid receptor synthesized at dorsal root



ganglion<sup>28-34</sup>) and they are distributed to not only central but also peripheral through first afferent neuron.<sup>35-36</sup>) Opioid effect at peripheral is not easily detected in normal tissue. But when inflammatory reaction occurs, opioid receptor already appears at peripheral nerve in minutes to hours.<sup>5,37,38</sup>) Functional roll of peripheral pain blocking  $\mu$ -opioid receptor is well known by pain regulating model with peripheral activating drug or low dose opioid agonists.<sup>39</sup>)

Jessell and Iversen<sup>40</sup>) discovered that opioid analgesics inhibit substance P release from primary afferent nerve fiber at trigeminal nerve, so they found that opioid receptor present at trigeminal nucleus. Tegeder et al.<sup>41</sup>) discovered that low dose of morphine-6-b-glucuronide local injection in human muscle had analgesic effect caused by concentric or eccentric muscle contraction. Bakke et al.<sup>42</sup>) found that local morphine injection to temporomandibular joint could inhibit jaw muscle activation by inflammatory stimulation and this fact explains the regulating function of opioid receptor in temporomandibular joint. Ro et al.<sup>8</sup>) investigated whether inflammation in the orofacial muscle alters  $\mu$ -opioid receptor mRNA and protein expressions in trigeminal ganglia, and assessed the contribution of peripheral  $\mu$ -opioid receptors under acute and inflammatory muscle pain conditions with rats. They concluded that activated peripheral  $\mu$ -opioid receptor in inflammatory muscle blocked pain more effectively and this amplified  $\mu$ -opioid receptor are contributed by  $\mu$ -opioid receptor synthesizing rate at trigeminal ganglia. Eisenberg et al.<sup>43</sup>) showed the peripheral and systemic antinociceptive effect of morphine local injection on formalin-induced facial pain behavior. They concluded that activation of peripheral opioid receptor contributed to reduce nociceptive stimulation and hyperalgesia. Local administration of  $\mu$ -opioid receptor accelerator in animal research, Houghton et al.<sup>44</sup>) discovered the blockade of bony pain, Catheline et al.<sup>45</sup>) and Truong et al.<sup>46</sup>) discovered the blockade of neuropathic pain, and Ko et al.<sup>47</sup>) said the diminution of hyperalgesia and allodynia related to

inflammatory pain in monkeys.

Same as the animal research, peripheral administration of opioid has a good analgesic effect in human study. Activated peripheral opioid receptor has a powerful analgesic effect to chronic rheumatoid osteoarthritis, inflammatory toothache and post-operative visceral pain.<sup>48-53</sup>) Modi et al.<sup>9</sup>) discovered buprenorphine with bupivacaine for intraoral nerve blocks to provide postoperative analgesia in patients after minor oral surgery could not prolong the anesthetic time but the time of postoperative analgesic duration could prolonged three times. Analgesic effect of peripheral opioid receptor is known more effective when inflammatory state but, in none inflammatory knee joint surgery morphine administration has an analgesic effect.<sup>54-56</sup>) In the study of Ziegler et al.<sup>10</sup>) analgesic effect of intra-articular morphine in patients with temporomandibular joint disorders, morphine 10mg had the longest and prominent analgesic effect. From this study they had an analgesic effect on non inflammatory patient so they concluded sufficient dose of morphine could more effective on inflammatory patients.

Analgesic effect of peripheral opioid receptor has been studied steadily, but clinical study on human masticatory muscle has not been performed actively. So in this study we injected low dose of morphine to masseter muscle of myofascial pain patients who were diagnosed from RDC/TMD and we confirmed the analgesic effects in 60 minutes, compared the results with lidocaine and saline injection.

The results of VAS test show that morphine injection group decreased the most, followed by lidocaine injection group with time. But the saline injection group had little changed.(Fig. 1) The results of MGQ test show that morphine injection group decreased steeply the most with time, lidocaine injection group decreased obviously after 10 minutes, but saline injection group had little changed.(Fig. 2) The results of PD test show similar pattern in morphine injection group and lidocaine injection group with time, but a quite

different pattern in saline injection group. Especially, difference between saline injection group and morphine injection group, and difference between saline injection group and lidocaine injection group were remarkable.(Fig. 3)

The VAS( $p<0.001$ ) and MGQ test( $p<0.001$ ) were significantly different statistically in within the groups. PD test was significantly different statistically in within the group( $p<0.001$ ) and between the groups( $p<0.001$ ). As a result, VAS, MGQ and PD test, all were significantly different statistically in within subject effects, but only PD test was significantly different statistically in between subject effects.(Table 2) Thus we tried Post Hoc to the PD test which was significantly different statistically in within and between subject effects. Inspecting for the lidocaine injection group in priority, morphine injection group was not significantly different statistically but saline injection group was significantly different( $p=0.002$ ). Inspecting for morphine injection group in priority, both lidocaine injection group and saline injection group were not significantly different statistically. Inspecting for the saline injection group in priority, both lidocaine injection group( $p=0.002$ ) and morphine injection group( $p=0.001$ ) were significantly different statistically.(Table 3)

The results of PPT test show that morphine injection group, lidocaine injection group and saline injection group had similarly increasing tendencies with time by 30 minutes.(Fig. 4) But the saline injection group showed low threshold range compared to morphine injection group and lidocaine injection group. The PPTol test shows relatively variable tendencies with time.(Fig. 5) The PPT( $p<0.001$ ) and PPTol test( $p<0.001$ ) were significantly different statistically in within the groups. However, the PPT test was significantly different statistically in between the groups( $p=0.025$ ), too. As a result, both PPT and PPTol test were significantly different statistically in within subject effects, but only PPT test was significantly different statistically in between subject effects. (Table 4) Thus we tried Post Hoc to the PPT test

which was significantly different statistically in within and between subject effects. Inspecting for the lidocaine injection group in priority, morphine injection group was not significantly different statistically but saline injection group was significantly different( $p=0.025$ ). Inspecting for morphine injection group in priority, both lidocaine injection group and saline injection group were not significantly different statistically. Inspecting for the saline injection group in priority, lidocaine injection group was significantly different statistically ( $p=0.025$ ), but morphine injection group was not significantly different statistically.(Table 5)

Therefore, it was considered that the morphine injection was effective to pain control for masticatory muscle pain patients within 60 minutes. It could be further investigation on time extension.

## V. CONCLUSIONS

The present study was designed to evaluate the pain control effect by morphine injection to masticatory muscle pain patients who were recruited to this study and diagnosed by Research Diagnostic Criteria for Temporomandibular Disorders(RDC/TMD). Experimental group were divided into three groups; saline injection group( $n=10$ ), lidocaine injection group( $n=10$ ) and morphine injection group( $n=10$ ).

Evaluation list was the subjective pain evaluation(visual analogue scale, Mc Gill pain questionnaire, pain drawing) and the objective pain evaluation(pressure pain threshold, pressure pain tolerance) and evaluation time was injection before, after 10min, 30min, 60min and then it was analyzed statistically.

The results were as follows :

1. The subjective pain evaluation and the objective pain evaluation were significantly different statistically in within subject effects( $p<0.001$ ).
2. The subjective pain drawing evaluation( $p<0.001$ ) were significantly different statistically in between subject effects.
3. The objective pressure pain threshold evaluation

( $p=0.025$ ) were significantly different statistically in between subject effects.

- The morphine injection group( $p=0.001$ ) were more significantly different than the saline injection group statistically in the subject pain drawing evaluation.

Therefore, it was considered that the morphine injection was effective to pain control for masticatory muscle pain patients within 60 minutes. It could be further investigation on time extension.

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국문초록

## Morphine에 의한 저작근 통증의 조절 효과

경희대학교 치의학전문대학원 안면통증구강내과학교실<sup>1</sup>, 경희대학교 구강생물학연구소<sup>2</sup>

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이 연구는 Morphine을 이용한 저작근통증의 조절 효과를 확인하기 위해서 시행되었으며, 경희대학교 치과대학병원 구강내과에 내원한 환자 중 RDC/TMD로 진단된 지원자를 saline 주사군, lidocaine 주사군, morphine 주사군 각각 10명씩 배정하였다. 통증부위에 주사 전, 주사 후 10분, 30분, 60분에 각각 주관적인 통증 평가인 시각유추척도검사, 맥길통증설문지검사 그리고 통증부위표시검사와 객관적인 통증 평가인 압력통증역치검사와 압력통증한계검사를 실시하였다.

검사 후 평가된 자료를 통계 처리하여 다음과 같은 결과를 얻었다.

1. 주관적인 통증 평가와 객관적인 통증 평가 모두 집단 내 효과가 있었다. ( $p < 0.001$ )
2. 주관적인 통증 평가인 통증부위표시검사( $p < 0.001$ )에서 집단 간 효과가 있었다.
3. 객관적인 통증 평가인 압력통증역치검사( $p = 0.025$ )에서 집단 간 효과가 있었다.
4. 주관적인 통증 평가인 통증부위표시검사는 morphine 주사군( $p = 0.001$ )이 saline 주사군에 비해서 효과가 있었다.

이상의 연구결과로 저작근에 통증이 있는 환자에게 morphine 주사 시 60분 이내에는 주관적인 평가에서 통증 조절 효과가 있었으며, 향후 시간 연장에 따른 지속적인 추가 연구가 필요 할 것으로 생각된다.

**주제어:** 저작근 통증, Morphine sulfate, 측두하악장애,

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