A Study on Synovial Fluid Analysis of Chronic TMD and Effects of Pumping Technique

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Ⅰ. INTRODUCTION

Temporomandibular joint pain and dysfunction can be caused by many different etiologic factors, e.g., neuromuscular hyperactivity(bruxism), malocclusion, trauma, disc dislocations, degenerative joint change and inflammatory joint disease[1,2]. And symptoms present are often similar, such as TMJ area pain, TMJ sound and limitation of mouth opening, etc. The role played by inflammation as an underlying mechanism of pain and dysfunction of the TMJ has been investigated[3], and radiographic, cellular, or biochemical signs of inflammation were frequently found in the TMJs of patients who had long-standing pain and tenderness in this joint. Synovial fluid analysis for evaluation of biochemical change in joints has been most commonly used in the knee joint[4,5], and it has also been used for the TMJ since 1960[6]. It is a valuable procedure in diagnosing organic disease of the TMJ, and is important in proving cause and extension of this disease[7-9], and can be a marker for treatment effect[10].

There are several possible methods to obtain a joint fluid samples, e.g., by direct aspiration through a needle inserted into the joint cavity[3], by washing the joint cavity with saline through a needle[11-13] or by sampling during an arthroscopic or surgical procedure[14]. During the past decade, saline aspirates of the upper joint space of TMJ have been increasingly analysed for the presence of various mediators of pathology. However, it is not known whether it is possible to obtain a representative sample of the synovial fluid. Furthermore, contamination of the aspirate with blood is an important source of error in published results of TMJ synovial fluid analysis [15]. Therefore, there have been several studies for a marker such as, radio-isotopes[16], radiographic contrast medium[17], albumin[18], aspirin[15] and vitamin B_{12}[19] which can measure the dilution rate of synovial fluid by injection of saline.

It is hard to make a definite conclusion on the natural process of TMJ ID, but the evidence suggests that ID is transferred to a degenerative process after condylar locking[20]. Also, according

to a recent research report, continuity within TMJ ID-Degenerative Joint Diseases-Dysfunction is not so well predicted as Rasmussen suggested, but in about 7% of patients whose TMJ noises make no trouble, there is progression to TMJ noises with problem in about 1 to 7.5 years[21], some of which have progressed to a more severe state, i.e., anterior disc displacement without reduction[22]. If this state continues, often pain continues and occlusal adjusting appliances, physical therapy and medications are ineffective. Especially in the case of degenerative change of TMJ, it is difficult to improve symptoms of TMJ noise, pain and limitation of opening with conservative therapy[23].

In 1986, Murakami et al[24] described successful treatment of TMJ closed lock with arthroscopic lavage and blunt trocar ablation of adhesions in the superior joint space, and also described a form of arthrocentesis that combined an insufflation of the superior joint space through one port using a gentle pumping action followed by manipulation of the jaw in 1987[25]. And intra-articular injections of corticosteroids, which is known as effective anti-inflammatory agent[36] in patients who fail to respond to conservative treatment had a long-term palliative effect on subjective symptoms and clinical signs of TMJ pain[27-29]. But due to the unpredictable prognosis of repeating intra-articular injections of corticosteroids[30,31], there is a need for supplementary therapeutic agent. There have been several studies on intra-articular injection of sodium hyaluronate since 1960. It has been shown that repeated injections of sodium hyaluronate on joint tissues of animals and humans does not produce permanent deleterious changes[32], and this has been investigated in several patients with TMJ osteoarthritis[28].

The aim of this study is to investigate the effect of intra-articular pumping technique and sodium hyaluronate injection into the joint and to analyze synovial fluid of the joint after unsuccessful initial treatment involving conventional manipulation technique and conservative therapy. Author use aspirin for a marker of dilution rate of synovial fluid by saline.

II. MATERIALS AND METHODS

1. Subjects

Eleven subjects(mean age : 31.2±8) who were diagnosed with degenerative joint disease or chronic closed lock by clinical examination participated in this study. They were drawn from the patients who visited the Orofacial Pain Clinic of Dept. of Oral Medicine and Oral Diagnosis, Seoul National University Dental Hospital and who had little improvement of symptoms with conservative treatments such as physical therapy or occlusal splint.

2. Method

(1) Clinical Examination

Maximum mouth opening and comfortable mouth opening were measured by incisal distance with standard ruler. After manual palpation of TMJ area, presence of tenderness and degree of pain were measured in VAS(visual analogue scale) for each surface(superior, lateral and posterior surface). And also, degree of pain at rest and maximum mouth opening wes presented VAS. Radiographic examination of the TMJ included standard panorama, transcranial TMJ view and TMJ panorama for evaluation of degenerative change. All clinical examination were performed according to time as pre- treatment, immediately after, 1week after, and 4weeks after treatment.

(2) Aspirin Administration

All subjects were administrated 1g of aspirin orally 1 hour prior to collection of synovial fluid.

(3) TMJ pumping method and synovial fluid collection

TMJ anesthesia was achieved by blocking the auriculotemporal nerve with 2% lidocaine. Assistant distracted the mandible downwards and forward. After palpation of the preauricular depression and the outer rim of the glenoid fossa, 21 gauge needle was used to puncture the skin. The point of entry was 1㎝ in front of the tragus on a line drawn from the tragus to the outer canthus of the eye. The needle was angled upwards, forwards and medially towards the posterior slope of the articular eminence. After contact with the bone, the needle was slightly withdrawn and its position in the joint space was performed by manipulation of the mandible which caused the needle to move, and the easy flow of the saline. Pumping technique was performed with 3㎖ of normal saline. The jaws were opened and closed a few times to ensure adequate equilibration of the saline within the synovial fluid and then aspiration was done.

(4) Intra-articular injection of sodium hyaluronate

1.5㎖ of sodium hyaluronate(ARTZ®, Seikagaku and Kaken, Japan) was injected into the upper joint space. Antibiotics were given and cold pack for 2days were instructed.

(5) Collection of blood plasma

3㎖ of blood sample was collected immediately after collection of the synovial fluid. All samples were put into heparinized bottles and centrifuged (3000rpm/5min) and then stored at -70℃ until analysis.

(6) Synovial fluid analysis

① Analysis of hyaluronic acid

Hyaluronic acid concentration was measured with uronic acid carbazole reaction[33]. 0.5ml of collected synovial fluid sample was added into 3.0ml sulfuric acid reagent(0.025M sodium tetraborate · $10H_2O$) under cooling. The tubes were shaken with constant cooling and then heated for 10min in a vigorously boiling distilled water bath and cooled to room temperature. Then 0.1ml of carbazole reagent(0.125% carbazole in absolute ethanol) was added. The tubes were heated in boiling bath for further 15min, and cooled to room temperature. The optical density was read at A_{530}(Ultrospec 2000, Pharmacia Biotech Ltd.) and glucuronolactone(Sigma Chemical Co.) was used as standard.

② Analysis of total protein

Concentration of total protein were calculated according to the following formula with measurement of optical density at A_{280} and A_{260}.

$$\text{Protein concentration(mg/ml)} = 1.5 \times A_{280} - 0.75 \times A_{260}$$

③ Analysis of albumin

Concentration of albumin was calculated according to the following formula with measurement of optical density at A_{628} with albumin assay kit(Sigma Chemical Co.).

$$\text{Albumin conc.(g/dL) of sample} = \frac{A_{sample} - A_{blank}}{A_{standard} - A_{blank}} \times \text{conc. of standard}$$

④ Analysis of salicylate

Analysis of salicylate in synovial fluid and in plasma was measured was by high performance liquid chromatography(HPLC) method. 200㎕ of sample(plasma or saline aspirate) were treated with 25㎕ of 1M-HCl and extracted with 10㎖ of diethyl ether on a vortex mixer for 2min. Pyrogallol(1,2,3-trihydrobenzene) which is present in diethyl ether as a stabilizer served as an internal standard. After separation, the ethyl ether layer was evaporated in a water bath at 40℃ and the residue was dissolved in 225㎕ of the mobile phase

containing 5%(v/v) 1M-HCl. HPLC was carried on a Waters 600E(Millipore Co. U.S.A.) chromatography system at 254nm on a uv/vis detector. The column was a Shandon 5 ODS reverse-phase(25cm x 4.6mm). The mobile phase was 30mM sodium citrate/27.7mM sodium acetate buffer(pH 4.75)-methanol(94:6) at a flow rate of 1mℓ/min.

(7) Correction of synovial fluid contents concentration

Dilution factor of saline aspirate was calculated according to following formula with the ratio of the concentration of the salicylate in the joint relative to that of the plasma. The concentrations of hyaluronic acid, total protein and albumin of synovial fluid were calculated using dilution factor by multipling to analysed concentrations.

$$\text{DF(dilution factor)} = \frac{\text{Conc. of aspirin in Blood plasma}}{\text{Conc. of aspirin in Synovial fluid}}$$

(8) Statistical analysis

Student T-test and analysis of variance (ANOVA) were used with SAS program in IBM PC.

Ⅲ. RESULTS

Temporomandibular joints of eleven patients were classified by clinical and radiographic results as followings. The number of chronic closed lock group were 7, DJD group were 4. In the chronic closed lock group, salicylate concentrations of saline aspirate and plasma of were 2.96 ± 0.70 and 0.72 ± 0.51(μM), dilution factor was 6.17 ± 3.45. In the DJD group, salicylate concentrations and dilution factor were 3.11 ± 1.04, 1.48 ± 0.99(μM) and 4.35 ± 5.68. There were no significant differences between the two groups. Dilution factor of synovial fluid of total patients were 1.4-12.9(5.5±4.2), and had a wide range(Table 1).

The concentrations of hyaluronic acid, total protein and albumin of the saline aspirate did not show significant difference between chronic closed lock group and DJD group. Corrected concentrations of HA and total protein by dilution factor of chronic closed lock group averaged 766.86 μg/mℓ, 11.86 mg/mℓ and those of DJD group averaged 277.71 μg/mℓ, 1.84 mg/mℓ. There was significant a difference between two groups($p<0.05$) but, concentration of albumin did not show significant difference(Table 2).

Mean of maximum mouth opening of chronic closed lock group were 34.6mm and that of DJD group were 53.5mm. Immediately after pumping and sodium hyaluronate injection, chronic closed lock group on the averaged gained 8.3mm addi

Table 1. Means and standard deviation of salicylate concentration(μM) and dilution factor

	Chronic Lock(n=7)	DJD(n=4)	Total	p
salicylate conc.(μM) of Plasma	2.96 ± 0.70	3.11 ± 1.04	3.01 ± 0.79	NS
salicylate conc.(μM) of Aspirate	0.72 ± 0.51	1.48 ± 0.99	1.00 ± 0.78	NS
Dilution Factor	6.17 ± 3.45 (1.74-10.39)	4.35 ± 5.68 (1.35-12.88)	5.51 ± 4.20 (1.35-12.88)	NS

DJD : Degenerative Joint Disease NS : Not Significant

Table 2. Mean value of synovial fluid contents

	Chronic Lock(n=7)	DJD(n=4)	Total(n=11)	p
HA(㎍/㎖)	133.55 ± 44.62	140.85 ± 115.40	136.21 ± 72.13	NS
Total Protein(㎎/㎖)	2.07 ± 1.65	0.56 ± 0.43	1.47 ± 1.48	NS
Albumin(㎎/㎖)	0.021 ± 0.019	0.015 ± 0.012	0.018 ± 0.016	NS
Cor. HA(㎍/㎖)	766.86 ± 481.67	277.71 ± 118.49	588.99 ± 452.02	*
Cor. Tot. Protein(㎎/㎖)	11.86 ± 7.80	1.84 ± 2.02	7.86 ± 7.87	*
Cor. Albumin(㎎/㎖)	0.102 ± 0.077	0.095 ± 0.160	0.100 ± 0.106	NS

DJD : Degenerative Joint Disease
Cor. : Corrected with dilution factor
* : P<0.05

Table 3. Change of mouth opening immediate after pumping and sodium hyaluronate injection

	Chronic Lock(n=7)	DJD(n=4)	Total	p
Pre Tx	34.6 ± 5.8	53.5 ± 7.9	41.5 ± 11.4	**
After Tx	42.9 ± 3.5	54.8 ± 7.4	47.2 ± 7.7	**
Change	8.3 ± 4.2	1.3 ± 1.9	5.7 ± 4.9	*
p	**	NS	**	

DJD : Degenerative Joint Disease
** : P<0.01
NS : Not Significant
* : P<0.05

tional opening, and showed significant difference before and after treatment(p<0.01) but, DJD group on the averaged gained 1.3㎜ additional opening and showed no significant difference (Table 3).

Dysfunction and degree of pain in patients before treatment, 1week after, and 4weeks after-treatment were compared. Although dysfunction and degree of pain showed a tendency to decrease according to time(pre-treatment in both groups, 1week after and 4weeks after treatment), there was no significant difference. But, chronic closed lock group showed significant difference in dysfunction index(DI) and in degree of pain on maximum opening between pre-treatment and 4weeks after treatment(p<0.05)(Table 4).

Table 4. Comparison of mean value of examined indices according to progression of time after pumping and sodium hyaluronate injection

	Variables	Pre-Tx	1Wk	4Wk	ANOVA	p
Chronic Lock (n=7)	PI	0.12±0.10	0.09±0.08	0.12±0.10		
	DI	0.41±0.11	0.29±0.11	0.25±0.14		*(Pre, 4Wk)
	Comfortable Opening	31.1±6.0	35.7±6.2	37.6±5.0		
	Maximum Opening	34.6±5.8	37.9±6.0	40.0±3.1		
	Resting Pain(VAS)	0	0.1±0.4	0.2±0.4	NS	
	Opening Pain(VAS)	4.4±2.1	3.9±2.9	1.2±1.8		*(Pre, 4Wk)
	Lateral Cap.(VAS)	0.6±1.1	0.9±1.2	0.6±0.9		
	Sup. Cap.(VAS)	1.7±2.4	1.0±1.4	0.4±0.9		
	Post. Cap.(VAS)	1.9±2.0	2.1±2.3	0.6±1.3		
DJD (n=4)	PI	0.16±0.11	0.04±0.06	0.09±0.10		
	DI	0.29±0.10	0.19±0.11	0.19±0.07		
	Comfortable Opening	50.75±7.4	46.5±7.8	50.7±9.1		
	Maximum Opening	53.5±7.9	47.5±6.4	51.7±7.5		
	Resting Pain(VAS)	2.5±3.2	3.0±4.2	2.3±3.2	NS	
	Opening Pain(VAS)	3.3±1.7	3.5±3.5	3.0±2.0		
	Lateral Cap.(VAS)	2.0±1.8	1.5±2.1	1.3±1.5		
	Sup. Cap.(VAS)	1.8±2.1	0	0		
	Post. Cap.(VAS)	1.5±2.4	0	0		

PI : Palpation Index
DI : Dysfunction Index
VAS : Visual Analogue Scale
Cap. : Capsule tenderness
DJD : Degenerative Joint Disease
NS : Not Significant
* : $P<0.05$

Ⅳ. DISCUSSION

Synovial fluid analysis for evaluation of biochemical change in joints has been most commonly used in the knee joint[4,5], and also for the TMJ since 1960[6]. Yehia et al[7] and Samuelson et al[8] reported that synovial fluid analysis plays an important role in the diagnosis and treatment of various types of joint diseases including inflammatory joint diseases. Patrick and Ward[9] reported that synovial analysis makes it possible to differentiate between septic lesions of joints and those caused by gout and that it also has a subsidiary role in the diagnosis of TA(traumatic arthritis), DJD(degenerative joint disease), RA (rheumatoid arthritis) and SLE (systemic lupus erythematosus).

Synovial fluid has been collected in the knee joint by direct aspiration. But in a small joint like the TMJ, this method seldom yields the joint fluid volume required for analysis, and the use of arthroscopy or surgical procedures of the joint is

not justified for analysis and likely to cause a greater alteration in the mediators of pathology[15], therefore the method that has been commonly used in TMJ is washing the joint with saline[11-13]. As far as the problem in synovial fluid analysis is concerned, Kopp[3] argued that the difficulties in obtaining the synovial fluid with saline aspiration technique of TMJ, which results in an underestimation of the biochemical changes in TMJ disease, are due to dilution and the anatomy of the TMJ. So, it is needed to find a standard marker for dilution rate.

Aghabeigi and his colleague[15] suggested that a marker was needed with following properties : 1), It should be safe to administer to the patients. 2),It should attain a measurable level shortly after administration. 3), Low levels should be measurable in highly diluted saline aspirates. 4), It should have equal concentrations in both plasma and synovial fluid. They chose to administer 1.2g of aspirin which fulfills previously mentioned properties, to patients 1-2 hours prior to aspiration. By comparing the salicylate concentration in the aspirate with that of the plasma, they could calculat the volume of synovial fluid, concentration and absolute amounts of the mediators of pathology in the joint. This method is based on the assumption that the salicylate concentration in the synovial fluid is similar to that in plasma. Several studies support this assumption[34,35]. Alstergren et al[19] studied the reproducibility and accuracy of a new method to measure TMJ fluid concentrations of a various substances by saline washing, using exogenous vitamin B_{12} as a marker of joint fluid dilution, which does not penetrate biological membrane without special transport mechanisms and therefore remains in the joint cavity during saline washings. They reported that saline washing with exogenous vitamin B_{12} is reliable for measurement of joint fluid concentrations of various substances. In this study author, used aspirin which has a therapeutic benefit by reducing post operative pain and discomfort. To calculated the dilution factor and correct concentrations various substances of joint fluid components by comparing the salicylate concentration in the aspirate with that of the plasma. In the chronic closed lock group salicylate concentrations of saline aspirate and plasma of were 2.96 ± 0.70 and 0.72 ± 0.51(μM), dilution factor was 6.17 ± 3.45. In the DJD group, salicylate concentrations and dilution factor were 3.11 ± 1.04, 1.48 ± 0.99(μM) and 4.35 ± 5.68. There were no significant differences between two groups. Dilution factor of synovial fluid of total patients were 1.4-12.9(5.5±4.2), and showed wide range. Author obtained that dilution rate does not differ between different joint diseases and that it is related to its size.

Synovial membrane in normal state is comparatively impermeable so that blood cell and plasma protein with large molecular weight cannot pass easily, so there exists small amount of plasma protein[6,7,9] and few blood cells[3] in the synovial fluid compared to proteins in the plasma. Actually materials over 100 angstroms in diameter cannot pass through the synovial membrane[36]. Kushner and Somerville[37] studied into the permeability of human synovial membrane, reporting that the amount of proteins differs according to the degree of inflammation, and that it reaches 2-10 times that of normal value, which increases in direct proportion to the degree of inflammation and the total amount of proteins. After Israel[11] examined the inflammatory state of synovial membranes using arthroscopy and took synovial fluids from 20 patients who were diagnosed as TMJ ID patients and then analyzed the relationship, he reported that the average protein concentration increase according to the inflammatory state of the synovial membrane. Chung et al[38] analyzed the synovial fluid from 60 joints with pathologic changes and 10 normal joints and reported that total amount of protein averaged

0.205 ㎎/㎖ in the latter and 1.259 ㎎/㎖in the former.

Normal synovial fluid has a high concentration of HA and this material enables the fluid to have high consistency and it plays an important role in lubricating the TMJ[7,8,39]. Dahl et al[40] reported that the concentration of HA is often lower in joints with disease than in normal joints. In this study, author compared the concentrations of hyaluronic acid, total protein and albumin between chronic closed lock group and DJD group. The concentrations of hyaluronic acid, total protein and albumin of the saline aspirate did not showed significant difference between chronic closed lock group and DJD group. Corrected concentrations of HA and total protein by dilution factor of chronic closed lock group were higher than those of DJD group, and there was a significant difference. But, concentration of albumin did not show a significant difference. The difference of concentration of the total protein showed that inflammation in the chronic closed lock group is more severe than that of the DJD group but, that of the hyaluronic acid showed opposite result. If more studies for normal status of joints and other stages of disease are done in the near future, it is sure to aid in understanding the role of inflammation in joint disease.

Murakami et al[25] studied mandibular manipulation with hydraulic pressure to the upper joint cavity using a pumping technique following betamethasone injection in 10 patients who were not relieved of closed lock even after initial treatment involving conventional manipulation technique and conservative therapy, and reported that this procedure immediately relieved the closed lock in nine of 10 patients and seven of the nine patients had no recurrence of the closed lock for six months. Corticosteroids are known as have a long-term palliative effect on subjective symptoms and clinical signs of TMJ pain. However, deleterious effects of steroids on joints have been reported, such as destruction of articular cartilage, infections and progression of existent joint diseases[30,31]. Thus Wollheim[41] recommended an interval of at least four weeks between corticosteroids injections and that injections in each joint should not exceed 3 times. Sodium hyaluronate is a very long polysaccharide chain which is made up of repeating disaccharide units of N-acetyl glucosamine and glucuronic acid. Different inhibiting effects on inflammation have been demonstrated, e.g., direct inhibition of leukocyte activity(phagocytosis and prostaglandin release) in acute inflammation as well as in chronic proliferative arthritis[42]. The permeability barrier of the synovial membrane might be reinforced, reducing the leakage of leukocytes and other migrating cells containing proteolytic enzymes. Hyaluronate has also been found to have an inhibitory effect on formation of granulation tissues and gross structural changes of joints.

In 1985, Kopp et al[43] compared the short-term effect of intra-articular injections of sodium hyaluronate and corticosteroids in the TMJ that had not responded to previous conservative treatment, and reported that the difference between the drugs in short-term therapeutic effects is small, and that sodium hyaluronate could be used as an alternative to corticosteroids for patients who have signs of TMJ inflammation, especially for those who have symptomatic osteoarthrosis. In 1987[44], they studied long-term effects of both drugs used for at least six months, and reported that both drugs have a significant long-term effect on chronic arthritis of the TMJ and that either of the drugs can be helpful ; however sodium hyaluronate might be the best alternative due the fact it shows least risk for side effects. In this study author performed pumping technique into the upper joint space with saline, and injected sodium hyaluranate. Immediately after

pumping and sodium hyaluronate injection, chronic closed lock group gained on the averaged of 8.3㎜ additional opening and showed significant difference but, DJD group on the average gained 1.3㎜ additional opening and showed no significant difference. These results were similar to the results of research of Ozawa et al[45]. They studied the effects of pumping technique into the lower and/or upper joint compartments of forty patients using hydraulic pressure from an imaging X-ray medium, reporting that there was an average improvement of 6.6㎜ in the degree of interincisal opening, and that satisfactory opening (at least 40㎜) was achieved immediately in 13 of these patients. Dysfunction and degree of pain in patients before treatment, 1week after and 4weeks after treatment were compared. Although dysfunction and pain in both groups showed a tendency to decrease according to time(pre-treatment, 1week after and 4weeks after treatment), there were no significant differences. But, chronic closed lock group showed significant difference in dysfunction index(DI) and pain on maximum opening between pre-treatment and 4weeks after treatment. Pumping technique and intra-articular injections of sodium hyaluronate seem to have the most effect immediately but the effect does not persist for a long time. Investigation of results after four weeks shows that the symptoms tend to get better, so author suggests that further study is needed for evaluation of long term effects.

V. CONCLUSIONS

The aim of this study is to investigate the effect of intra-articular pumping technique and sodium hyaluronate injection into the joint and to analyze synovial fluid of the joint after unsuccessful initial treatment involving conventional manipulation technique and conservative therapy. Pumping and injection of sodium hyaluronate was performed to alleviate pain and opening limitation, correct concentration of synovial fluid contents were analyzed using aspirin concentration difference between plasma and saline aspirate in order to prevent change in concentration by saline dilution.

The obtained results were as follows :

1. Dilution factor of synovial fluid of total patients were 1.4-12.9(5.5±4.2), and showed wide range.
2. There was no significant difference between dilution factor of chronic closed lock group(6.2 ±3.5) and that of degenerative joint disease group(4.4±5.7).
3. Concentration of synovial fluid contents did not show a significant difference between chronic closed lock group and degenerative joint disease group, but corrected concentrations of HA and total protein by dilution factor showed significant differences between two groups.
4. Immediately after pumping and sodium hyaluronate injection, chronic closed lock group gained on the average of 8.3㎜ additional opening and showed significant difference but, DJD group gained on the average of 1.3㎜ additional opening and showed no significant difference.
5. Although both dysfunction and pain in both groups showed a tendency to decrease according to time(pre-treatment, 1week after and 4weeks after treatment), there was no significant difference. But, chronic closed lock group showed significant differences in dysfunction index(DI) and pain of maximum opening between pre-treatment and 4weeks after treatment.

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국문초록

만성 악관절장애환자의 활액분석 및 악관절 도약술의 효과에 관한 연구

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본연구는 임상검사 및 방사선 사진상 악관절장애로 진단된 환자중 물리치료, 악관절 안정장치 등의 보존적 치료방법을 시행하였으나 증상의 개선이 별로 없는 퇴행성 관절질환이나 중등도의 개구제한을 가진 환자를 대상으로하여 aspirin을 이용한 활액성분 분석 및 악관절 도약술과 sodium hyaluronate의 주입을 시행한후 이에 따른 치료결과를 평가하기 위하여 시행되었다. 평균연령이 31.2세(21-42세)인 11명의 악관절 장애환자를 대상으로 하였다.

악관절 도약술과 sodium hyaluronate의 주입은 악관절의 동통과 개구제한의 해소를 위해 시행되었으며 그 결과를 시술전, 시술 즉시, 시술 1주후 및 4주후로 나누어 분석하였으며 활액 채취시 생리식염수의 희석에 의한 활액성분의 농도 변화에 따른 오차를 막고자 활액과 혈액내의 aspirin의 농도차를 이용하여 정확한 활액성분농도를 측정하였다. 이상의 연구를 통하여 다음과 같은 결론을 얻었다.

1. 전체 환자의 생리식염수에 의한 악관절 활액의 희석계수는 1.4-12.9(5.5±4.2)로 상당히 넓은 범위를 나타내었다.
2. 만성 폐구성 과두걸림 환자군(n=7)의 생리식염수에 의한 활액의 희석계수(6.2±3.5)는 퇴행성 관절질환을 갖는 환자군(4.4±5.7, n=4)과 유의한 차이가 없었다.
3. 만성폐구성 과두걸림군과 퇴행성 관절질환군간의 활액성분의 농도는 유의한 차이가 없었으나 희석계수를 이용한 수정된 Hyaluronic acid와 총단백질의 농도는 만성 폐구성 과두걸림군의 경우에서 유의하게 더 높게 나타났다.
4. 악관절 도약술과 sodium hyaluroante의 주입 직후 만성 폐구성 과두걸림 환자군의 경우 평균 8.3㎜의 추가적인 개구 증가로 유의한 차이가 관찰되었고 퇴행성 관절질환의 경우 평균 1.3㎜의 추가적인 개구증가가 있었으나 유의한 차이가 관찰되지 못했다.
5. 시술전, 시술 1주후 및 4주후의 여러 검사항목을 비교한 결과 두군에서 모두 시간의 경과에 따라 기능이상 및 동통 감소의 경향을 나타내었으나 유의하지는 않았으며 만성 폐구성 과두걸림의 경우 기능장애지수(dysfunction index) 와 최대개구시 동통의 정도는 시술전과 시술 4주후간에 유의한 차이가 관찰 되었다.

주요어 : 악관절장애, 악관절 도약술, sodium hyaluronate, aspirin