Influencing factors on the prognosis of arthrocentesis

by

Yoon Ho Kim

Major in Oral & Maxillofacial Surgery
Department of Clinical Dentistry
Graduate School of Clinical Dentistry
Ajou University

Influencing factors on the prognosis of arthrocentesis

by
Yoon Ho Kim

Supervised by
Seung Il Song, DDS, Ph.D.

Major in Oral & Maxillofacial Surgery
Department of Clinical Dentistry
Graduate School of Clinical Dentistry
Ajou University
July, 2015

This certifies that the dissertation
of Yoon Ho Kim is approved.

SUPERVISORY COMMITTEE

Seung Il Song

Kwang Woo Baek

Jeong Keun Lee

Graduate School of Clinical Dentistry
Ajou University
June, 19, 2015

- ABSTRACT -

Influencing factors on the prognosis of arthrocentesis

Yoon Ho Kim

Department of Clinical Dentistry

Ajou University Graduate School of Clinical Dentistry

(Supervised by assistant professor Seung Il Song)

Objectives: The purpose of this study is to evaluate factors influencing prognosis of arthrocentesis in patients with temporomandibular joint(TMJ) disorder.

Materials and Methods: The subjects included 145 patients treated with arthrocentesis at the Dental Center of Ajou University Hospital from the year of 2011 to 2013 for the purpose of recovering mouth opening limitation and pain relief. Prognosis of arthrocentesis was evaluated one month after the operation. Improvement on mouth opening limitation was defined as an increase from below 30mm (MOL$\leq$ 30mm) to above 40mm (MOL$\geq$ 40mm), and pain relief was defined as when a group with TMJ pain VAS(visual analog scales) 4 or more <TMJ pain(VAS$\geq$ 4)> decreased to scale 3 or more. The success of arthrocentesis was determined when either mouth opening improved or pain relief fulfilled. To determine the factors influencing the successs of arthrocentesis, the patients were classified by age, gender, diagnosis groups (Anterior disc displacement without reduction group, Anterior disc displacement with reduction group, TMJ disorder etc. group), time of onset and oral

habit(clenching, bruxism) to investigate the correlations between these factors and prognosis.

Results: One hundred twenty-one out of 145 patients with arthrocentesis were found to be successful. Among the influencing factors mentioned above, age, diagnosis and time of onset had no significant correlations with the success of arthrocentesis. However, a group of patients in their fifties showed a lower success rate (ANOVA P=0.053) and the success rate of the group with oral habit was 71% (pearson Chi-Square test p=0.035).

Conclusion: This study showed factors influencing the success of arthrocentesis include age and oral habits. Also conclude that arthrocentesis is effective in treating mouth opening symptoms and for pain relief.

Key words : Arthrocentesis, Temporomandibular joint, Oral habit

TABLE OF CONTENTS

LIST OF TABLES

I. INTRODUCTION

Arthrocentesis is known to be an effective surgical approach to treating TMJ disorders. It is widely used for not only treating an acute closed lock but also various TMJ disorders. In the early days, a simple lavage after local anesthesia of superior joint space was performed to reset gliding of articular disc and mouth opening in connection with gliding for patients with closed lock (Nitzan et al, 1991). As numerous studies have been conducted by many researchers, it was applied to a wide range of indications, such as injecting corticosteroid or sodium hyaluronate (SH) in the superior joint space. Arthrocentesis has been developed and settled as not only a supplementary method of treating internal derangement, but a treatment method with satisfactory prognosis upon a long-term observation. In addition, it has been recognized as being a very simple operation with nearly no complications.

Several studies have found that arthrocentesis is capable of recovering normal mouth opening and reducing pain and functional disorder. Brennan and Ilankovan stated that arthrocentesis is a relatively simple surgical procedure for patients with pain that cannot be improved by conservative treatments(Brennan and Ilankovan, 2006), and Lee and Yoon reported that the patients with temporomandibular joint internal derangement were well treated as it was accompanied by arthrocentesis and stabilization splint therapy (Lee and Yoon, 2009). There is a study claiming that arthrocentesis is effective for degenerative joint diseases including degenerative arthritis, and Al-Belasy & Dolwick stated that arthrocentesis is clearly effective for a long period of time only for acute closed lock (Al-Belasy and Dolwick, 2007).

There have been a wide range of studies reporting the effectiveness of arthrocentesis, but the factors influencing the prognosis of operation are not well-known. When it comes to

prognosis of arthrocentesis, a lot of factors exist. Thus, it is important to check the influencing factors as well as the possibility and limitation of arthrocentesis.

In this regard, this study showed the factors influencing prognosis based on the arthrocentesis treated for patients hospitalized owing to temporomandibular joint disorder.

Ⅱ. PATIENTS AND METHODS

A. PATIENTS

The subjects include 145 patients with TMJ disorders accompanied by mouth opening limitation or pain hospitalized at the department of oral and maxillofacial surgery, dental center in Ajou University Hospital from January 2011 to January 2013 for arthrocentesis. They were 145 patients in total who may be included in the postoperative follow-up research.

B. METHODS

At the first medical examination, a conservative treatment of using medicine and physical therapy was applied for around 2 weeks. However, when there was no improvement or when not improved after stabilization splint therapy, arthrocentesis was carried out. Upon the operation, saline solution was used for cleaning and around 1.5cc of hyaluronic acid(Guardix-sol, Hanmi) was injected. In general, mouth opening limitation refers to the state in which a mouth cannot be opened within a normal range. Normal mouth opening may vary for every patient, but it is usually about 40~60mm. The distance between the upper anterior teeth and the lower anterior teeth is measured (Shah, 2000; Nelson et al, 1992). The difference is distinct by sex, and vertical mouth opening is larger in male. Many researchers have reported the range of mouth opening limitation in a wide range of diseases (Dworkin et al, 1990). In the study, the maximum mouth opening was the distance between the incisal edges of upper and lower central incisors (unit: mm) and pain was recorded according to the visual analog scales (VAS) with 10 scales (0: Without pain and 10: Intolerably severe pain). When the vertical space between the incisal edges of upper and lower incisors when the mouth was opened at maximum was 30mm or shorter, it was classified as mouth opening

limitation, and when mouth opening increased from below 30mm to above 40mm, it was regarded as improvement in mouth opening limitation. Using VAS, improvement in pain was determined as more than 3 indexes are reduced from scale 4 or larger. The effectiveness of arthrocentesis was evaluated after 1 month of operation, and when either mouth opening limitation is recovered or pain is reduced, it was regarded as effective for treatment. Postoperative predictive factors include the patient's gender, age, TMJ disorder type, time of onset and oral habit, and they were used to classify patients for analyses. The patients treated with arthrocentesis were divided into 3 groups – Articular disc displacement without reduction group, Articular disc displacement with reduction group, TMJ disorder etc. (with pain of degenerative arthritis, capsulitis, synovitis and etc) group. Based on 3 months as the point when TMJ disorder started, it is classified into chronic and acute, and the groups were divided according to whether there is oral habit or not. Oral habit included clenching and bruxism. In cases of patients with oral habit, occlusal stabilizing splint therapy was done.

SPSS (version 17.0, SPSS Inc., Chicago, IL, USA) software was used for statistical analyses of postoperative predictive factors. Independent variables included the gender, age, TMJ disorder type, time of onset and oral habit and dependent variable was prognosis of arthrocentesis. For an analysis by age, the groups were divided by age group (for instance, the patients of teenagers, at twenties, thirties and etc) and Pearson Chi-Square analysis was used for analyses by gender, TMJ disorder type, time of onset and oral habit. Logistics Regression analysis and ANOVA analysis were used for the analyses by age. The significance level at all statistical procedure was 0.05% for all variables under assessment.

Ⅲ. RESULTS

The subjects consisted of 41 male patients and 104 female patients (Table 1.) with age distributing wide from 13 to 66 and the average age was 39.4. There were 57 patients from age group 10~20 and 36 patients from 30~40 and 52 patients who were more than 50 years old (Table 1). There were 48 patients in the anterior disc displacement without reduction group, 28 patients in the anterior disc displacement with reduction group and 69 patients in the TMJ disorder etc. group (Table 2). There were 72 patients with acute TMJ disorder and 73 patients with chronic TMJ disorder. There were 31 patients who had oral habit (Table 3).

Table 1. Gender and age distribution(n=145)

Variable	Patients(n)
Gender	
Male	41
Female	104
Age(yr)	
10-29	57
30-49	36
>50	52

Table 2. Demographic data classified by diagnostic group (n=145)

Diagnostic group	Patients(n)
ADD with reduction	48
ADD without reduction	28
Other TMJ disorders.	69

(ADD: Anterior disc displacement , TMJ: Temporomandibular joint)

Table 3. Demographic data classified by time of onset and oral habits (n=145)

Variable	Patients(n)
Time of onset	
Acute	72
Chronic	73
Oral habits	
Group with oral habits	31
Normal group	114

Among 145 patients with arthrocentesis, 121 patients claimed to have improvements, where the success rate was 83.4%. The success rate was 80.5% for male patients and 84.6% for female students, and 84.2% for age group 10~20s, 94.4% for age group 30~40s and 75% for age group 50s or more. According to the diagnostic group, the success rate was 83.3% for ADD with reduction group, 82.1% for ADD without reduction group and 84.1% for TMJ disorder etc. group. When it comes to the time of onset, the success rate was 86.1% for the acute onset group and 80.8% for the chronic onset group. The success rate of the group with oral habit was 71% and that of the group without oral habit was 86.8% (Table 4).

As a result of the prognostic factors significance test, age (P=0.053 >.05), gender (P=0.547>.05), diagnostic group (P=0.974>.05), time of onset (P=0.392>.05) and group with oral habit (0.035<.05) were shown. A significant result was obtained from the group with oral habit (Table 5). In case of the age factor, the patients were divided into 6 groups. The success rate of age group 10-20s was around 80% in average, and increased to about 90% at age group 30-40s. Then, it decreased to around 70% at age group 50-60s. Thus, it could not be explained using a linear regression equation, making it statistically invalid upon logistics regression analyses. When the patients were divided into 3 groups - 10~20, 30~40 and 50~60 – p-value was 0.053(ANOVA analysis, a figure approximate to the significant level of 0.05.

Table 4. Comparative analysis of prognostic factors of arthrocentesis for TMJ (n=145)

Variable	Patients (n)		Success rate
	Success	Failure	(%)
Arthrocentesis	121	24	83.4
Gender			
Male	33	8	80.5
Female	88	16	84.6
Age(yr)			
10-29	48	9	84.2
30-49	34	2	94.4
≥50	39	13	75.0
Diagnostic group			
ADD with reduction	40	8	83.3
ADD without reduction	23	5	82.1
Other TMJ disorders	58	11	84.1
Time of onset			
Acute	62	10	86.1
Chronic	59	14	80.8
Oral habits			
Group with oral habits	22	9	71.0
Normal group	99	15	86.8

(TMJ: temporomandibular joint, ADD: anterior disc displacement)

Table 5. Prognostic factor significance test results

Prognostic factor	P-value
Age	0.053
Gender	0.547
Diagnosis group	0.974
Time of onset	0.392
Oral habit	**0.035**

Ⅳ. DISCUSSION

When a TMJ disorder occurs, the patients mainly suffer greatly from pain and mouth opening limitation. There have been many reports on the causes of such pain and mouth opening limitation and several studies on synovial fluids.

Normal synovial fluid has an extremely small amount of protein owing to selective permeability of synovial sheath when compared to that of blood plasma. Here, albumin accounts for 60~75% and very small amount of globulin and transferrin exists. Also, hyaluronic acid is created by the cells near synovial sheath, having an important role to the lubrication mechanism of TMJ. However, when inflammation occurs at the synovial sheath, the amount of protein increases as the permeability of synovial sheath accelerates and the amount of transferring and IgG increases as well. Moreover, the amount of hyaluronic acid decreases owing to the functional disturbance of cells (Yi et al, 2000).

In particular, it is clinically significant in that the contents of substance P and macromolecule fibrin which are known as the materials delivering pain within the synovial fluid of the patients claiming chronic pain.

Considering that the friction between the articular disc and the superior joint space has a great impact on the mandibular movement, it is believed that an inflammatory reaction caused by long-term external injury and changes to secretion of synovial fluids caused by damages to the subsynovial tissue play a crucial role in the vicious cycle of pain and mouth opening limitation.

Alpaslan *et.al* insisted that it is more effective to inject hyaluronic acid during arthrocentesis for pain, mouth opening limitation and clicking sound(Alpaslan, 2001). Hyaluronic acid is a macromolecular polysaccharide composed of a repeating disaccharide

unit created by B-type synovial cells as well as the main component of synovial fluids. It plays an important role for joint lubrication and homeostatsis at articular joint space(Fraser et al, 1979; Balazs, 1974). Hyaluronic acid included in 1-2um layer of the joint cartilage surface relates to restoration of cartilage surfaces, and it acts as a buffer to protect the cartilage cells from trauma. It has been reported that hyaluronic acid removes fee radiacals, inhibits creation of granulation tissue, supplies nutrients to the avascular parts of joints, reduces vascular permeability, deters migration of polymorphonuclear leukocyte and macrophage and encourages anti-inflammation like phagocytosis(Rydell and Balazs, 1971). In addition, Miyazaki et.al reported that hyaluronic acid has an analgenic effect(Kim, 2006). The study also took consideration of the benefits of hyaluronic acid when performing arthrocentesis.

Various studies have found that arthrocentesis can result in the normal maximum mouth opening and reducing pain and inconveniences. Overall success rate shown in this study was 83%. This is higher than that reported by Murakami et.al (70%) and Hosaka et.al (79%), but lower than that reported by Nitzan et.al (91%, 95%) (Murakami et al, 1995; Hosaka et al, 1996; Nitzan et al, 1997).

In the study, it was discovered that arthrocentesis was effective for 121 out of 145 patients. Thus, it can be determined that arthrocentesis is capable of reducing pain and improvement in mouth opening limitation. Age and the group with oral habit as the prognosis determinants are notable. Examining the success rate by age group, the average of 10-20s was around 80%, and increased to around 90% in 30-40s and decreased to around 70% in 50-60s. P-value upon statistical analyses with 3 groups was 0.053(ANOVA analysis, $p>0.05$), yet approximate. It is believed that age may impact prognosis of arthrocentesis. In other words,

the success rate of a group with fifties may decrease. Also, a group with oral habit showed a low success rate of 71% (Pearson Chi-Square test $p=0.035<0.05$).

Murakami et.al concluded that age can be an influential factor in predicting the result of arthrocentesis since the average age of failed cases was 39, which was fairly higher than the average age of successful cases, 27 (Murakami et al, 1995). Nitzan et.al stated that more time is required for recovery for patients in 40s or older (Nitzan et al, 1997), and Guarda reported that arthrocentesis using HA is less effective for young patients under 45 (Guarda et al, 2012).

Nishimura et.al claimed that it is effective for patients suffering from articular disc displacement without reduction(Nishimura et al, 2001) and is less effective when bony change is detected at mandibular condyle(Sakamoto et al, 1996). Alpaslan assumed that arthrocentesis is likely to be more effective for patients without bruxism (Alpaslan et al, 2003).

Park reported that it is more effective in improving mouth opening and reducing pain when splint therapy is performed along with arthrocentesis (Park et al , 2010).

In the study, it is assumed that the success rate of a group with oral habit before/after arthrocentesis is low since the bad oral habits including clenching and bruxism reduce the therapy effect. Bruxsim is thought to be one of the major contributing factors to the aetiology of TMD. Patients with myofacial pain dysfunction syndrome, and who are prone to clenching or bruxism may develop disc derangements(Ghanem, 2011). In this study, splint therapy was also performed in case of the group with oral habit for reducing forces directed to temporomandibular joint as well as the intraarticular pressure. But it is estimated that continuous stress in the disc and retrodiscal tissue during clenching and bruxism have an effect on the prognosis of arthrocentesis. It is limited in judging whether splint therapy has a

direct impact on arthrocentesis in this study.

Although there was no statistical significance, the success rates of an articular disc displacement without reduction group, an articular disc displacement with reduction group and a TMJ disorder etc. Group were high, and the success rate was high regardless of when the TMJ disorder was onset. These confirmed that arthrocentesis is an effective treatment in reducing pain and improving mouth opening limitation.

Since prognosis of the operation was evaluated 1 month after arthrocentesis, the long-term success rate of the oepration could not be checked.

Ⅴ. CONCLUSION

Arthrocentesis is an effective treatment option tolerable by patients. Since it is less invasive than other surgical procedures, it can be easily done again, if required, actively recommended to surgeons in treating the patients with TMJ disorder. It was found in the study that arthrocentesis showed high success rates and was effective in recovering mouth opening and reducing pain. The factors influencing the prognosis of operation may be diverse and complex. However, as the patients in their fifties or older receive arthrocentesis, the success rate is likely to be low. Also, it was discovered that arthrocentesis may be less effective when the patients have bad oral habits.

REFERENCES

1. Yi AN, Han SY, Yun KI: Clinical aspect of arthrocentesis. J Korean Assoc Oral Maxillofac Surg 26(1):97~104, 2000
2. Kim JJ: The effect of intra-articular injection of hyaluronic acid after arthrocentesis in treatment of internal derangements of the TMJ. J Korean Assoc Oral Maxillofac Surg 32(5):453~457, 2006
3. Park YH, Lee SH, Yoon HJ: An effect of combination with arthrocentesis and stabilization splint treatment on temporomandibular joint disorder patient. J Korean Assoc Maxillofac Plast Reconstr Surg 32:32-36, 2010
4. Ghanem WA: Arthrocentesis and stabilizing splint are the treatment of choice for acute intermittent closed lock in patients with bruxism. J Craniomaxillofac Surg 39:256-260, 2011
5. Brennan PA, Ilankovan V: Arthrocentesis for temporomandibular joint pain dysfunction syndrome. J oral Maxillofac surg 64:949-951, 2006
6. Al-Belasy FA, Dolwick MF: Arthrocentesis for the treatment of temporomandibular joint closed lock: a review article. Int J Oral Maxillofac Surg 36:773-782, 2007
7. Shah K: Trismus: a bizarre finding. Br J oral Maxillofacial Surg 38:397-398, 2000
8. Sakamoto I, Yoda T, Tsukahara H, Morita S, Miyamura J, Yoda Y, et al: Clinical studies of arthrocentesis of the temporomandibular joint- Analysis of clinical findings in patients with a good outcome. Jpn J Oral Maxillofac Surg. 42:808-814, 1996

9. Nelson SJ, Nowlin TP, Boeselt B: Consideration of linear and angular values of Maximum mandibular opening. Compendium 13:362, 364, 366 passim, 1992
10. Rydell N, Balazs EA: Effect of intra-articular injection of hyaluronic acid on the clinical symptoms of osteoarthritis and on granulation tissue formation. Clin Orthop 80:25-32, 1971
11. Alpaslan GH, Alpaslan C: Efficacy of temporomandibular joint arthrocentesis with and without injection of sodium hyaluronate in treatment of internal derangements. J Oral Maxillofac Surg 59:613-618, 2001
12. Dworkin SF, Huggins KH, LeResche L, Von Korff M, Howard J, Truelove E, et al: Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls, J AM Dent Assoc 120:273-281, 1990
13. Alpaslan C, Dolwick M.F, Heft MW: Five-year retrospective evaluation of temporomandibular joint arthrocentesis. Int. J. Oral Maxillofac. Surg. 32:263-267, 2003
14. Nitzan DW, Samson B, Better H: Long-term of arthrocentesis for sudden-onset, persistent, severe closed lock of the temporomandibular joint. J Oral Maxillofac Surg 55:151-157, 1997
15. Lee SH, Yoon HJ: MRI findings of patients with temporomandibular joint internal derangement: before and after performance of arthrocentesis and stabilization splint. J Oral Maxillofac surg 67:314-317, 2009
16. Hosaka H, Murakami K, Goto K, Iizuka T: Outcome of arthrocentesis for

temporomandibular joint with closed lock at 3 years follow-up. Oral Surg Oral Med Oral Pathol 82: 501-504, 1996

17. Fraser JRE, Clarris BJ, Baxter E: Patterns of induced variation in the morphology, hyaluronic acid secretion and lysosomal enzyme activity of cultured synovial cells. Ann Dis 38:287-294, 1979
18. Nishimura M, Segami N, Kaneyama K, Suzuki T. Prognostic factors in arthrocentesis of the temporomandibular joint: evaluation of 100 patients with internal derangement. J Oral Maxillofac Surg 59:874-877, 2001
19. Nitzan DW, Dolwick MF, Martivez GA: Temporomandibular joint arthrocentesis: A simplified treatment for severe, limited mouth opening. J Oral Maxillofac Surg 49:1163-1167, 1991.
20. Balazs EA : The physical properties of synovial fluid and the special role of hyaluronic acid. In : Helfet AJ, ed. Disorders of the Knee. Philadelphia: Lippincott 61-64, 1974
21. Guarda-Nardini L, Olivo M, Ferronato G, Salmaso L, Bonnini S, Manfredini D: Treatment effectiveness of arthrocentesis plus hyaluronic acid injections in different age groups of patients with temporomandibular joint osteoarthritis. J Oral Maxillofac Surg 70:2048-2056, 2012
22. Murakami K, Hosaka H, Moriya Y, Segami N, Iizuka T: Short-term treatment outcome study for the management of temporomandibular joint closed lock. A comparison of arthrocentesis to nonsurgical therapy and arthroscopic lysis and

lavage. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 80:253-257, 1995

턱관절세정술의 치료예후에 영향을 미치는 요인

목적: 본 연구는 턱관절 장애(TMJ disorder)를 갖고 있는 환자들에게 시행한 턱관절 세정술의 예후에 영향을 미치는 요인에 대해 평가하고자 하였다.

대상 및 방법: 2011년부터 2013년까지 아주대학교 병원 치과 진료센터에서 개구제한 및 동통 완화를 목적으로 턱관절세정술(arthrocentesis)을 치료 받은 145명의 환자를 대상으로 평가하였다. 한달의 경과 관찰 후 턱관절 세정술의 예후를 평가하였다. 개구 제한의 개선은 개구제한 30mm이하(MOL $\leq$ 30mm)에서 40mm이상(MOL$\geq$ 40mm)으로 증가한 경우로 정의하였으며 동통 완화는 TMJ pain VAS(visual analog scales) 4이상<TMJ pain(VAS$\geq$ 4)> 의 그룹에서 scale 3이상 감소한 경우로 정의하였다.턱관절 세정술의 성공은 개구량 증가 혹은 동통 완화 중 하나라도 만족시 성공으로 결정하였다. 턱관절 세정술 성공에 영향을 미치는 요인을 알아보기 위해 나이, 성별, 진단 그룹(Anterior disc displacement wihtout reduction group, Anterior disc displacement with reduction group, TMJ disorder etc. group), 발병시기, 구강악습관(이악물기, 이갈이)유무 그룹으로 나누어 각 요인들과 예후와의 상관 관계에 대해 조사하였다..

결과: 턱관절 세정술 받은 환자 145명중 121명(83.4%)가 성공 기준에 해당하였다. 턱관절세정술 성공에 영향을 미치는 요인 중 성별, 진단, 발병시기는 통계학적으로 의미있는 상관관계는 없었다. 그러나 나이 그룹에서는 50대 그룹에서 좀 더 낮은 성공률(ANOVA P=0.053)을 보였으며 구강악습관 그룹에서 성공률이 71%를 보였다.(pearson Chi-Square test p=0.035).

결론: 본 연구의 결과는 턱관절 세정술의 성공에 영향을 미치는 요인으로 나이와 구강악습관 유무그룹을 들 수 있으며, 이와 더불어 턱관절 세정술이 개구 제한 회복과 동통 완화에 있어서 효과적인 치료임을 확인하였다.

핵심어 : 턱관절세정술, 측두하악관절, 구강악습관