2008년 2월

博士學位論文

한 현 요 미 통 경 에 을 서 이 고 용 주 한 파 디 시 스 술 크 의 제 효 거 용 술 성 후 분 발 석 생

김 석 원

2008 년 2 월

박사학위논문

현미경을 이용한 디스크 제거술 후 발생한 요통에서 고주파 시술의 효용성 분석

Effect of radiofrequency neurotomy for low back pain and buttock pain after microscopic discectomy

조 선 대 학 교 대 학 원

의 학 과

김 석 원

현미경을 이용한 디스크 제거술 후 발생한 요통에서 고주파 시술의 효용성 분석

Effect of radiofrequency neurotomy for low back pain and buttock pain after microscopic discectomy

2008년 2월 일

조 선 대 학 교 대 학 원

의 학 과

김 석 원

현미경을 이용한 디스크 제거술 후 발생한 요통에서 고주파 시술의 효용성 분석

지도교수 신 호

이 논문을 의학 박사학위신청 논문으로 제출함

2007 년 10 월 일

조 선 대 학 교 대 학 원

의 학 과

김 석 원

김석원의 박사학위논문을 인준함

위원장 조선 대학교 교수 임 경 준 인

위 원 조선 대학교 교수 박 치 영 인

위 원 조선 대학교 교수 이 승 명 인

위 원 조선 대학교 교수 김 종 규 인

위 원 조선 대학교 교수 신 호 인

2008 년 2 월 일

조 선 대 학 교 대 학 원

목 차

그림 목차

표 목 차

ABSTRACT

Effect of radiofrequency neurotomy for low back pain and buttock pain after microscopic discectomy

Seok Won Kim
Director : Professor. Ho Shin M.D., Ph.D.
Department of Medicine
Graduate School, Chosun University

OBJECTIVE: There are many causes of low back pain and it has been demonstrated previously that percutaneous radiofrequency neurotomy (PRN) is an effective management of facet joint pain. But, there were few reports about the management of low back pain (LBP) or buttock pain after microscopic discectomy. Weight bearing on the facet joint is increased after microscopic discectomy. The purpose of this study was to evaluate the result of PRN for low back pain or buttock pain after microscopic discectomy in lumbar disc herniation.

METHODS: Seventy nine patients who were performed percutaneous radiofrequency neurotomy for severe LBP or buttock pain after microscopic discectomy were included in this study. Inclusion criteria

were severe low back pain or buttock pain after microscopic discectomy and ≥ 50% Visual Analogue Scale (VAS) reduction on diagnostic blocks. They were divided into two groups by the presence of preoperative LBP as preoperative back pain group (Group Ⅰ, n=40) and postoperative back pain group (Group Ⅱ, n=39). Pain relief was estimated at preoperative, 1 week, 1 month, 3 months and at 12 months following the procedure using VAS. Above 50 % pain relief was defined as the positive response. Quality of life was measured before and 3 months after treatment with the SF-36 questionnaire.

RESULTS: The procedures were successful in all cases. In all patients, neuritis, myalgia, hypoesthesia, and dysesthesia that may develop after PRN were not noted. Positive responses were shown in 34 patients (85%) at 1 week, 18 patients (45%) at 1 months, 15 patients (37.5%) at 3 months and 4 patients (10%) at 12 months after PRN in Group Ⅰ. In Group Ⅱ, 33 patients (85%), 31 patients (79.5%) and 29 patients (74.5%) and 24 patients (61.5%) responded positively after 1 week, 1 month, 3 months and 12 months after PRN respectively (P=0.0017). Based on the SF 36, the outcome parameters including vitality, pain and physical activities show significant improvement in Group Ⅱ.

CONCLUSION: PRN may be a safe and effective treatment for newly developed or aggravated back pain or buttock pain after microscopic discectomy.

Key Words : Low back pain, Buttock pain, Microscopic discectomy, Radiofrequency neurotomy

Introduction

Patients with herniated lumbar disc are well known to neurosurgeons and spine surgeons along with medical and surgical procedures. Despite the development of minimally invasive endoscopic discectomy, microscopic discectomy is a standard surgical procedure and treatment of choice for lumbar disc herniation (2,13). After microscopic discectomy, pain relief is expected for most patients; however, it is not a rule. Despite the relief of radiating pain, low back pain (LBP) presented prior to surgery may remain, or new back pain may develop after operation in some cases(5,10,12). It is the result of progression of degeneration or increased weight bearing on facet joint due to disc space narrowing. The reports on the overall clinical outcome and complications of discectomy are abundant (13,18,19). Nevertheless, the reports on the factors influencing the severity of postoperative back pain or its treatment are rare. Hence, we performed this study to evaluate the effect of PRN for the persistent or newly developed back pain after microscopic discectomy.

Patients and Methods

This study was performed on 79 patients who underwent PRN for low back pain or buttock pain. The patients were selected among the cases who received microscopic discectomy for one level lumbar disc herniation at our institute from January 2003 to August 2005. Microscopic discectomy was performed by same surgeon and he removed intervertebral lumbar disc as much as possible due to minimalization of the possibility of recurrence. The inclusion criteria of the study population were that among patients with LBP or buttock pain after microscopic discectomy, the cases without significant neurological deficits, without recurrence, inflammation or other specific findings in radiological study. Medial branch blocks were performed with fluoroscopic visualization, at 2 levels to block a single target joint. A positive response was considered as one with at 50% pain relief from a block of at least 2 hours duration when lidocaine was used, and longer than the duration of lidocaine when bupivacaine was used to eliminate false positive response. To clarify the weight bearing on facet joint, we divided the patients into two groups according to the onset of LBP or buttock pain. They were classified again into Group Ⅰ, LBP

presented prior to microscopic discectomy (n=40) and Group Ⅱ, mild LBP presented prior to microscopic discectomy but newly developed LBP or buttock pain after microscopic discectomy (n=39). The cases with worker's compensation, diabetes or infection were excluded from this study.

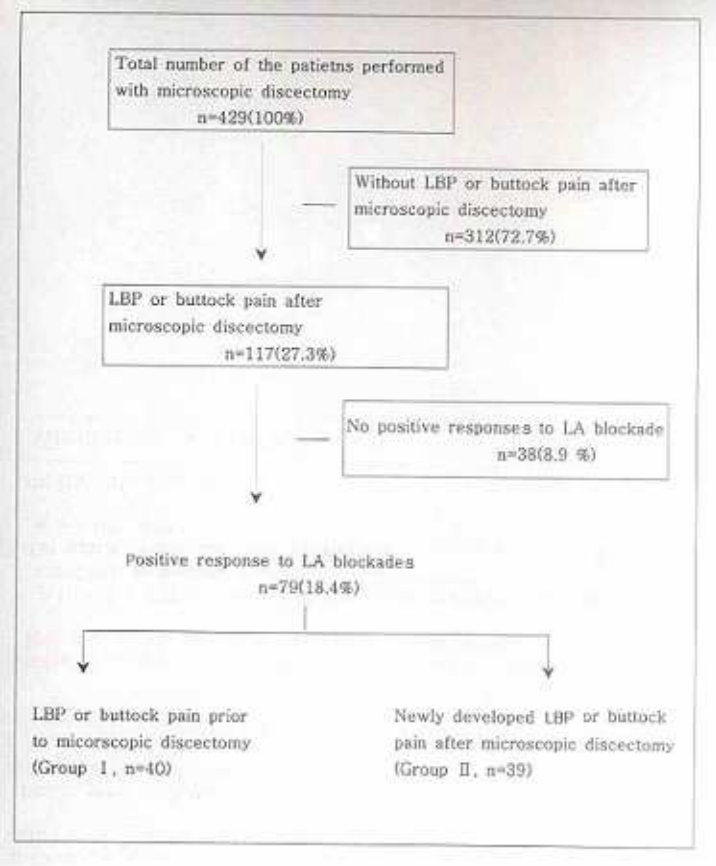

Fig. 1. Flow chart of inclusions of the patients.

Surgical technique

Diagnostic block

Using 22 guage needles, diagnostic medial branch block of 2 levels with 0.5ml to 1 ml of 2% lidocaine per level was performed under fluoroscopic guidance in the target joint. All patients judged to have a positive response with lidocaine block underwent subsequent bupivacaine block (0.25 ml to 0.5ml of 0.25% bupivacaine). For a given joint, both nerve above and the nerve below that innervate the joint need to be anesthetized. It is important to block both nerves that innervate the target joint. The L5-S1 joint is innervated by the medial branch of the L4 dorsal ramus(which crosses the L5 transverse process) and by the dorsal ramus of L5(which crosses the ala of the sacrum). The L4-L5 joint is innervated by the medial branches of L3 and L4, which cross the L4 and L5 transverse processes, respectively. So we performed medial branch block at the level of L3, L4 medial branch in case of L4-5 discectomy and L4 medical branch, L5 dorsal ramus in case of L5-S1 discectomy. In patients with significant bilateral LBP or buttock pain, both sides were blocked in the same session.

Radiofrequency neurotomy

The consent of patients was obtained by sufficiently explaining the procedure. On the radiolucent operative table, with the prone positioned patients, the C-arm fluoroscopy was adjusted to an A-P view, so that the superior and inferior margin of the vertebral body were merged as a single line. Subsequently, the imaging intensifier was rotated approximately 10-15 degrees to detect the pedicle well. Under X-ray inspection, a 22 guage with 5 mm active tip, 98 mm coated cannula (5mm active tip, NeuroTherm RDG E/M C100. 05) was inserted toward Burton's point where the superior articular process and transverse process meet. On the lateral radiography, its accurate location was confirmed. Subsequently, the probe was removed from the cannula and an electrode was inserted. High frequency thermal coagulation instrument (N50R, Leibinger, Germany) was connected to assess the sensory reaction first, under 50 Hz, 0.2~0.4 volts. Electric stimulation was confirmed by increasing gradually up to a maximally of 0.8~1.0 volts, burning dysesthesia was assessed. To evaluate the reaction of motor nerve, after the gradual increase of the voltage to 0.8 volts under 2 Hz , the fasciculation of the multifidus muscle controlled by the medial branch of posterior primary ramus was observed, and

once the fasciculation was confirmed, the voltage was raised to 3 volts, it was confirmed that the fasciculation did not occur in the muscles of lower limbs, and the lesion was made at 80 °C for 90 seconds. After the formation of the lesion, to prevent discomfort and the development of neuritis, 0.5ml of 1 % lidocaine and 5mg of triamcinolone acetonide (Tamcetone®, Hanol Inc., Korea) per lesion were administered and the surgical procedure was completed. PRN was performed two levels above and below the affected target joint, but, for patients with bilateral LBP, it was carried out on both sides like diagnostic blocks.

The surgical outcome of treatment was determined by using a predefined outcome measures of VAS-back, changes in daily physical activities and disability.

Evaluation of the pain was performed by applying the visual analogue scale (VAS). When we performed the VAS, the case with pain alleviation over 50% was considered as a positive response(11). It was performed at 1 week, 1 month, 3 months and 12 months after the procedure took place and the number of patients with the pain alleviation is presented as the percentage. Before treatment and at 3 months after treatment, median values of daily activities was determined (15) (Table 1).

Table 1. Physical Activities Scale*

* Derived form the Dutch Central Bureau of Statistics.

Physical Activities Scale	
On every specific activity the patients should answer if it can be performed "without difficulty," "with difficulty." "with help from others," or if it is "not possible," scoring responses 3, 2, 1, or 0 points. Maximum is 30 points	
Sitting down and standing up form a chair	Taking a long walk
Getting in and out of bed	Washing oneself (bathing, showering)
Dressing, putting on shoes, undressing	Bending over, lifting something
Sitting down during a longer period	Work, housekeeping, more strenuous hobbies
Walking outside	Fixing minor things at home

Disability of the patients was assessed before and 3 months after treatment using SF-36 health survey (17). Pre-and postoperative clinical characteristics and surgical outcome were compared by using paired t-tests, chi-square test and Fisher exact test. P-value less than 0.05 was considered statistically significant.

RESULTS

There were no intergroup significant differences in the demographic characteristics. (Table 2).

Table 2. Patients characteristics and baseline values of outcome parameters

	Group I (previous LBP)	Group II (Newly developed or aggravated back pain)
Number of patients	40	39
Mean age(years)	49.2	52.3
Male : Female	24:16	20:19
Body mass index	23.7	25.1
Level of discectomy		
L4-L5	27	29
L5-S1	13	10
Site of pain		
Unilateral	25	29
Bilateral	15	10

VAS-back*(SD)	5.2(1.6)	5.8(1.6)
Physical activities*(SD)	18.6(4.2)	19.4(4.1)
SF-36(SD)		
Physical functioning	42.9(19.3)	33.8(17.0)
Social functioning	59.7(23.1)	53.0(24.7)
Physical role restriction	20.0(37.6)	18.4(21.8)
Emotional role restriction	55.8(45.5)	70.3(41.4)
Mental health	62.9(21.8)	70.2(16.8)
Vitality	43.5(21.6)	49.2(19.6)
Pain	37.3(15.6)	31.2(15.3)
General health	56.8(21.9)	57.3(19.8)
Health changes	36.3(22.6)	28.4(20.5)

* Median value of 2 measurements during 2 weeks.

Patients characteristics showed adequate matching between both Groups.

In group I which had LBP prior to microscopic discectomy, pain alleviation was positive after 1 week (85%), after 1 month (45%), after 3 months (37.5%), and after 12 months (10%). In contrast, Group II which had newly developed back pain or buttock pain after microscopic discectomy, the pain alleviation was positive after 1 week

(85%), after 1 month (79.5%), after 3 months (74.5%), and after 12 months (61.5%). It was found that the pain relief was more continuous throughout the 1 year follow-up in Group II (Fig. 2 & Fig. 3).

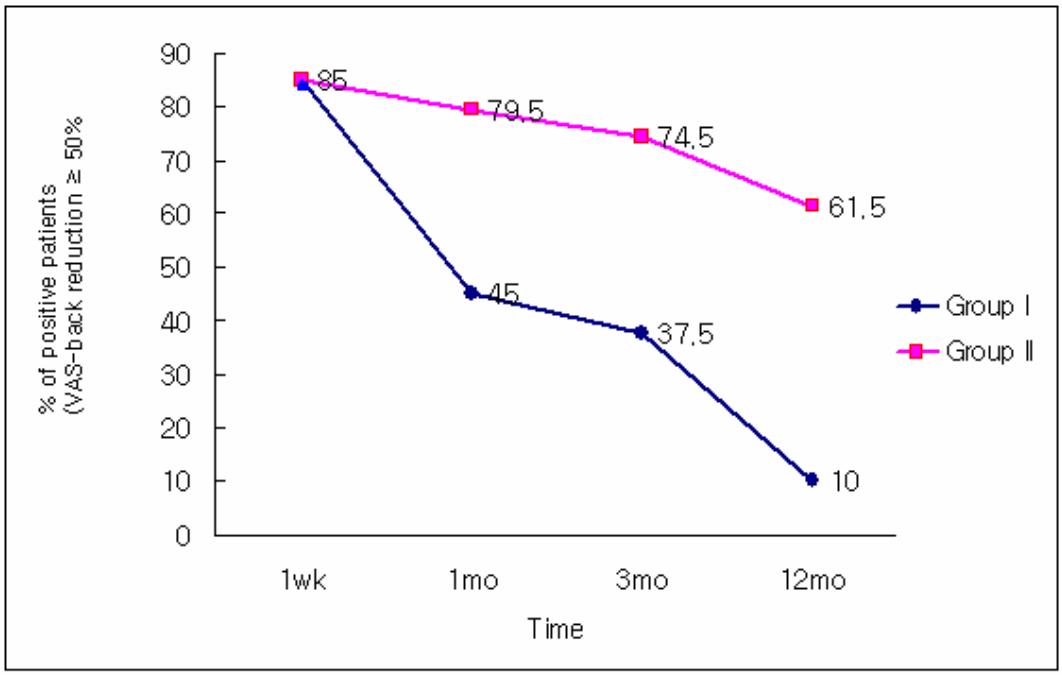

Fig. 2. Results of percutaneous radiofrequency neurotomy on the medial branch of posterior primary ramus between Group I and Group II ($P < 0.05$).

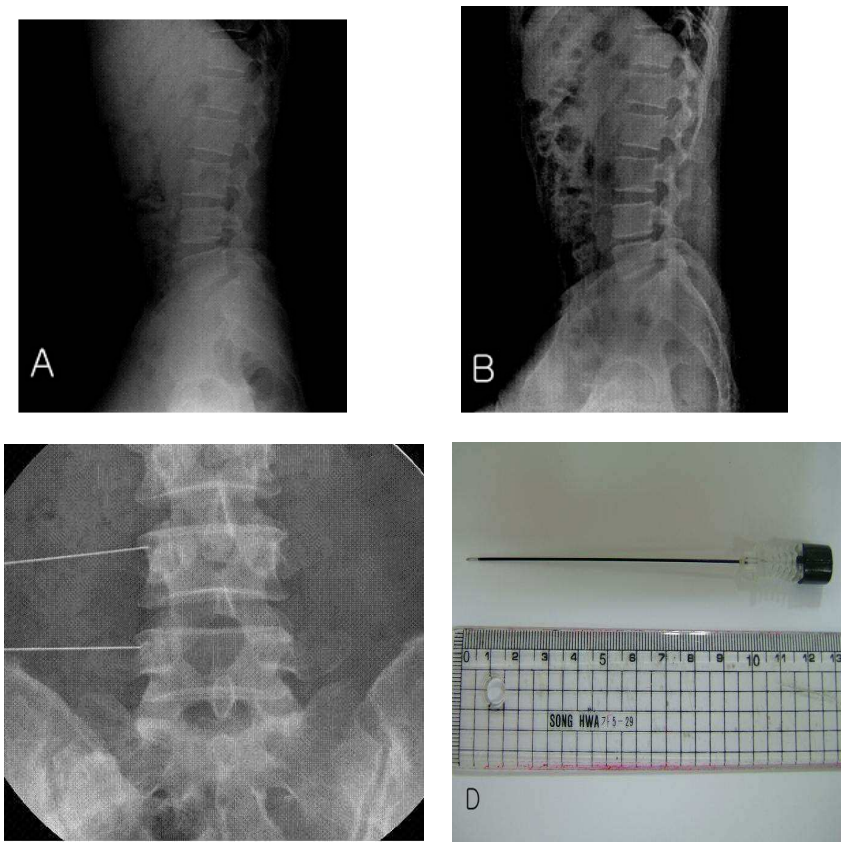

Fig. 3. A 46 year old woman who complained of severe newly developed LBP and Lt. buttock pain after microscopic discectomy at L4-L5 level.

A&B : Lateral radiographs checked at preoperative and 12 months later the operation show disc space narrowing at L4-L5 level.

C : Radiofrequency electrodes in position at the angle between the superior articular process and transverse process of L4 and L5 vertebra.

D : 5mm active tip, NeuroTherm RDG E/M C100. 05.

The results of physical activities and SF-36 parameters at 3 months follow-up are summarized in (Table 3).

Table 3. Surgical outcome after 3 months including physical activities and quality of life

	Group I	Group II
Mean change in physical activities*	3.2	7.8
SF-36(mean difference 0-3 months) (SD)		
Physical functioning	4.7(16.9)	7.87(19.7)
Social functioning	2.6(36.1)	5.4(29.6)
Physical role restriction**	10/3	11/8
Emotional role restriction**	4/10	7/3
Mental health	2.7(26.8)	0.7(23.9)
Vitality*	-1.3(14.6)	5.3(17.7)
Pain*	5.4(18.9)	11.6(20.6)
General health	1.8(13.6)	-1.3(17.5)
Health changes compared to 3 months before**	12/4	14/2

* χ^2 test, P-value less than 0.05 was considered statistically significant.

** The number of patients is shown that went up/ down 1 or more classes.

The physical activities and SF-36 questionnaire showed an significant improvement in the Group Ⅱ. Association between the components (VAS-back and physical activities) was assessed by computing partial correlation coefficients (within patients) between two of these variables. As expected, VAS-back and physical activities showed a negative partial correlation ($r=-0.50;P<0.01$).

DISCUSSION

The lumbar disc herniation is very common disease and microscopic discectomy is regarded as a good treatment option for lumbar disc herniation if severe pain or neurologic deficits persist after 4 to 6 weeks of conservative therapy (3). Microscopic discectomy is the most general surgical method, and it has been proven to be the safest method for the improvement of neurological symptoms such as radiating pain, motor weakness, and so on. Nevertheless, despite the improvement of radiating pain, the discomfort due to the residual low back pain presents prior to surgery or new low back pain or buttock pain developed after surgery have been reported. When patients with a

lumbar disc herniation underwent a microscopic discectomy, the changes of disc height in people of those with a postoperative degenerative disc change were notable. One of the most common changes seen is the disc space narrowing. Disc space narrowing increases facet loading, perhaps to such a level as to cause damage, and to pain. Patients who undergo microscopic discectomy must face the possible consequences of this increase in stress (5,10,12). Weight bearing on the lumbar vertebral area is distributed and supported by the anterior and posterior structure of vertebrae. In the anterior, the vertebral body and disc play an important role while in the posterior, the facet joint plays a main role with the ligaments maintaining the stability of posterior structures and intervertebral discs. When discectomy is performed for the lumbar disc herniation due to degenerative change of discs, the disc space becomes narrow resulting in the imbalance of weight bearing on spinal structures, and consequently, the weight bearing on the facet joint is increased (1). Several studies have reported the surgical outcome of microscopic discectomy. Finneson characterized the factors that influence the outcome of the surgery of lumbar disc hernaiton, and the selection of patients prior to surgery was particularly important (5). They have

reported prognosis determination, and as prognostic factor lowering the postsurgical score, back pain prior to surgery, obsesity, psychological factors, etc. were presented, and the postoperative prognosis was poor in the cases with such factors prior to surgery. Nevertheless, Dabbs has reported that in simple radiographic findings, the correlation of the narrowing of intervertebral disc space prior to surgery and backache was not detected (1). In our study, a good result was obtained for LBP which was newly developed or aggravated after microscopic discectomy, and it was thought weight bearing on the facet joint is increased. This difference of PRN effect may be a result of the direct nerve ending irritation in preoperative LBP versus increased weight bearing on facet joint in newly developed back pain. It is well known that the intervertebral discs contribute significantly to the lumbar stability. In axial loading, they serve to carry over 60% of compressive loads; excessive disc removal at the lower lumbar area could significantly decrease the buffering capacity of other spinal components from loading, leading to changes within the facet joints and an increase in mobility and therefore eventually to some postoperative instability with apparent consequences (6). It has been reported that facet joint irritation sign due to the facet joint syndrome

does not concur to the distribution of dermatomes, at the various steps of spinal location, symmetrically or asymmetrically, continuous pain was detected, it was exacerbated during the extension or flexion, and it may appear as the radiating pain in the buttock area or lower limbs, it shows normal findings in neurological examination. The diagnosis of facet joint pain is probable when there is at least 50% relief of the targeted pain after local anesthetic blockande of the medial branches of the posterior rami of the spinal nerves that supply the painful joints on two separate occasions. It has been demonstrated previously that PRN is an effective management of lumbar facet joint pain (11). In 1975, after Shealy reported a 70% success rate after perfoming RF facet denervation in patients with back pain, it was subsequently applied to the treatment of facet pain frequently with diverse success rates of 40-79% being reported (4,7). Dreyfuss et al. found that 60% of patients can expect 90% relief, and 87% can expect at least 60% relief of pain for about 12 months. Van kleef et al. also demonstrated that after 12 months, 70% of patients still doing well (4,16). In the present study, the author has shown that the effect and duration of relief after PRNs are similar to previous report. The mean duration of relief after PRNs remains fairly constant Group II compared to Group I.

There are several possible reasons of why Group II is more effective. These include progression of spinal degeneration with additional structures influencing facet joint loading in Group II. In Group I, the causes of back pain are thought as annular nociceptors suggesting near discogenic pain before microscopic discectomy. In comparison with the methods using neurolytic agents, PRN can form lesions accurately with selective destruction of the medial branch, and be feasible by controlling the temperature. It can distinguish motor-sensory components and lower the incidence of complication such as neuritis. It does not destroy adjacent tissues and thus a scar is not formed. Its advantage is that it can be performed repeatedly (9). Nevertheless, its limitation is that the alleviation of pain in patients can be only evaluated by subjective measures. Therefore, the evaluation of the objective result of PRN is difficult to conclude. Moreover, PRN doesn't cure facet joint pain and the effects on facet denervation are usually not permanent. Especially, the structural degenerative changes on facet joint can be induced for the patients who had microscopic discectomy. So, long-term follow up is necessary. However, we believe that PRN could be performed safely and effectively for newly developed LBP or buttock pain after microdiscectomy.

CONCLUSION

For newly developed or aggravated low back pain or buttock pain after microscopic discectomy, PRN may be considered as an effective and safe treatment option.

REFERENCES

1. Dabbs VM, Dabbs LG : Correlation between disc height narrowing and low-back pain. Spine 15 : 1366-1369, 1990

2. Davis RA : A long-term outcome analysis of 984 surgically treated herniated lumbar discs. J Neurosurg 80 : 415-421, 1994

3. Deyo RA, Weinstein JN : Low back pain. N Engl J Med 344 : 363-370, 2001

4. Dreyfuss P. Halbrook B. Pauza K. Joshi A. McLarty J. Bogduk N: Efficacy and validity of radiofrequency neurotomyfor chronic lumbar zygapophysial joint pain: Pain Practice 5 : 284-285, 2005.

5. Dunlop RB, Adams MA, Hutton WC : Disc space narrowing and the lumbar facet joints. J Bone Joint Surg Br 66 : 706-710, 1984

6. Finneson BE : Low back pain, ed 2. philadelphia : JB Lippincott 320-326, 1980

7. Fountas KN, Kapsalaki EZ, Feltes CH, Smisson HF, Johnston KW, Vogel RL, Robinson JS : Correlation of the amount of disc removed in a lumbar microdiscectomy with long-term outcome. Spine 29 : 2521-2524, 2004

8. Freeman BJ, Fraser RD, Cain CM, Hall DJ, Chapple DC : A randomized, double-blind, controlled trial: intradiscal electrothermal therapy versus placebo for the treatment of chronic discogenic low back pain. Spine 30 : 2369-2377, 2005

9. Hooten WM, Martin DP, Huntoon MA : Radiofrequency neurotomy for low back pain: evidence-based procedural guidelines. Pain Med 6 :129-138, 2005

10. Koh YD, Kim DJ, Kim JO, Wang JM, Bae SY, Chang SY : Clinical and radiologic factors predicting the low back pain after idscectomy . Journal of Korean Spine 9 : 178-183, 2002

11. Leclaire R, Fortin L, Lambert R, Bergeron YM, Rossignol M : Radiofrequency facet joint denervation in the treatment of low back pain: a placebo-controlled clinical trial to assess efficacy. Spine 26 : 1411-1416, 2001

12. Lee KJ, Ahn JS, Hong CH, Lee BJ : The changes of disc height and degeneration in patients with lumbar disc herniation. Journal of Korean Spine 12 : 58-62, 2005

13. Osterman H, Seitsalo S, Karppinen J, Malmivaara A : Effectiveness of Microdiscectomy for Lumbar Disc Herniation: A Randomized Controlled Trial With 2 Years of Follow-up. Spine 21 : 2409-2414, 2006

14. Schofferman J, Kine G : Effectiveness of repeated radiofrequency neurotomy for lumbar facet pain. Spine 29 : 2471-2473, 2004

15. Sullivan M, Ormel J, Kempen GI, Tymstra T : Beliefs concerning death, dying, and hastening death among older, functionally impaired

Dutch adults: a one-year longitudinal study. J Am Geriatr Soc 46 : 1251-1257, 1998

16. Van Kleef M, Barendse GA, Kessels A, Voets HM, Weber WE, de Lange S : Randomized trial of radiofrequency lumbar facet denervation for chronic low back pain. Spine 24 : 1937-1942, 1999

17. Ware JE Jr, Sherbourne CD : The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care 30 : 473-483, 1992

18. Weir BK : Prospective study of 100 lumbosacral discectomies. J Neurosurg 50 : 283-289, 1979

19. Yorimitsu E, Chiba K, Toyama Y, Hirabayashi K : Long-term outcomes of standard discectomy for lumbar disc herniation: a follow-up study of more than 10 years. Spine 26 : 652-657, 2001

저작물 이용 허락서

학 과	의학과	학 번	20067350	과 정	박 사
성 명	한글: 김 석 원	한문: 김 석 원	영문: Seok Won Kim		
주 소	광주광역시 동구 계림동 두산위브@ 104-401				
연락처	E-mail : chosunn@hanmail.net				
논문제목	한글: 현미경을 이용한 디스크 제거술 후 발생한 요통에서 고주파 시술의 효용성 분석				
	영문: Effect of radiofrequency neurotomy for low back pain and buttock pain after microscopic discectomy				

본인이 저작한 위의 저작물에 대하여 다음과 같은 조건아래 -조선대학교가 저작물을 이용할 수 있도록 허락하고 동의합니다.

- 다 음 -

1. 저작물의 DB구축 및 인터넷을 포함한 정보통신망에의 공개를 위한 저작물의 복제, 기억장치에의 저장, 전송 등을 허락함
2. 위의 목적을 위하여 필요한 범위 내에서의 편집·형식상의 변경을 허락함. 다만, 저작물의 내용변경은 금지함.
3. 배포·전송된 저작물의 영리적 목적을 위한 복제, 저장, 전송 등은 금지함.
4. 저작물에 대한 이용기간은 5년으로 하고, 기간종료 3개월 이내에 별도의 의사표시가 없을 경우에는 저작물의 이용기간을 계속 연장함.
5. 해당 저작물의 저작권을 타인에게 양도하거나 또는 출판을 허락을 하였을 경우에는 1개월 이내에 대학에 이를 통보함.
6. 조선대학교는 저작물의 이용허락 이후 해당 저작물로 인하여 발생하는 타인에 의한 권리 침해에 대하여 일체의 법적 책임을 지지 않음
7. 소속대학의 협정기관에 저작물의 제공 및 인터넷 등 정보통신망을 이용한 저작물의 전송·출력을 허락함.

동의여부 : 동의(O) 반 대 ( )

2008년 2월 일

저작자: 김 석 원 (서명 또는 인)

조선대학교 총장 귀하