

A Survey of Clinical Outcomes Following ACL Reconstruction in the Opium-Addicted Patients and Smoker Patients in Compare with Non-Addicted Patients

Abstract

Introduction: Anterior Cruciate Ligament (ACL) is an extra synovial element, and the fibroblasts are involved in its ongoing renewal and maintenance. It seems that opium addiction and smoking have destructive effects on the healing process and rehabilitation after its reconstruction. The present study investigates the clinical outcomes of ACL reconstruction surgery in the opium-addicted patients, smokers, nicotine- and opium-addicted patients, and regular patients.

Materials & Methods: In a prospective cohort study, 4 groups of patients who required ACL reconstruction were selected: Smokers, opium-addicts, nicotine plus opium-addicts, and regular. The results of ACL reconstruction in these four groups were evaluated using KOOS and Lysholm questionnaires as well as the KT-2000 system. The Chi-square test and independent sample t-test were used for analyzing the data, and a significant level was considered under 0.05.

Results & Discussion: The rate of displacement based on the KT-2000 system in the non-addicted group was significantly lower than that of the "addicted" groups. The severity of knee pain and the amount of difficulty in daily activities and exercise on the basis of KOOS-criteria in non-addicted subjects were significantly lower than those of the exposed groups. According to the Lysholm questionnaire, the patient's lameness score, support score, instability score, stair-climbing score, and squatting score in the non-addicted group were significantly higher than each of the other groups. The level of locking and swelling did not differ significantly.

Conclusion: The results of the current study generally showed that the clinical results of anterior cruciate ligament (ACL) reconstruction in the opium-addicted patients and smokers were significantly worse than the non-addicted patients. The results of KT-2000 system evaluation in following ups after 12 months, showed that the displacement rate in the non-addicted group was significantly lower than the other groups.

Keywords: Anterior cruciate ligament reconstruction, Opium addiction, Tobacco smoking.

Accepted: 31 days before printing

Amirreza Sadeghifar, MD¹, Amirreza Kalantari, MD¹, Mohamad Sheibani, MD²,
Elham al-Sadat Seyyed Ghasemi, MD³, Salman Azarsina, MD², Farnaz Hajtalebi, MD⁴

1. Department of Orthopedic Surgery, Kerman University of Medical Sciences, Kerman, Iran.

2. Department of Orthopedics, School of Medicine, Clinical Research Development Unit Shahid Madani Hospital, Alborz University of Medical Sciences, Karaj, Iran.

3. Student Research Committee, School of Medicine, Iran University of Medical Sciences, Tehran, Iran.

4. Student Research Committee, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran.

Corresponding Author:
Mohamad Sheibani, MD
Email address:
sheibani.mohamad@gmail.com

Introduction

Anterior Cruciate Ligament (ACL) is an extra Synovial element, and the fibroblasts are involved in its ongoing renewal and maintenance. This ligament is also involved in preventing the excessive tibia rotation and the angulation of Varus and Valgus in two directions. Damage or rupture of the Anterior Cruciate Ligament is the most common knee injury involving 40% of sports injuries. ACL damage causes knee instability⁽¹⁾. Also, this complication can cause problems in exercise efficiency of the patient and increase the risk of meniscus lesions and premature knee joint degeneration. The purpose of the reconstruction of anterior cruciate ligament is to provide knee with a stable function, reduce the symptoms, and return the patient to the level of pre-injury activity⁽²⁾. Addiction means a chronic and recurrent disease of the brain that despite the harmful consequences, is characterized by two features of obsessive-compulsive search and consumption. Addiction is defined as a brain disease because it changes the brain's chemicals as well as its structure and function. Opium is a bitter and narcotic substance derived from *Papaver Somniferum*. The natural and industrial derivatives of opium have significant effects on the physiology and behavior⁽³⁾.

Such individuals show symptoms of opioid-withdrawal, cardiovascular and hemodynamic changes, and many other problems during anesthesia and surgery. Also, these patients have difficulty during the healing process after surgical procedures due to drug use.

Tobacco has diverse types, all of which are deadly and addictive. Scientific evidence suggests that smokers are more likely to be affected by a variety of cancers, especially lung cancer, cardiovascular disease, respiratory illness, and fetal dysfunction⁽⁴⁾.

Previous studies have shown that smoking is in relation to the incomplete wound healing, delay bone union, and destructive effects on the immune system. Nicotine in the cigarette is, also, a potent vasoconstrictor which affects the angiogenesis process in the tissue. Finally, opium addiction and smoking have a bad effect on the process of rebuilding anterior cruciate ligament⁽⁵⁾.

On the other hand, the transplanted graft undergoes a ligamentation process during the rebuilding in order to complete the healing process, and factors such as cigarettes and opium are very effective in this process.

Thus, according to what mentioned before, and because there aren't many studies conducted on the complications caused by the addiction to the mentioned substances during the ACL reconstruction, the aim of the present study is to investigate the clinical outcomes of ACL reconstruction surgery in the opium-addicted patients, smokers, nicotine- and opium-addicted patients, and non-addicted patients.

Materials & Methods

This study is a prospective cohort study including the case group exposed to the risk factors, and control group non-exposed to the risk factors having inclusion criteria. The two groups were investigated in a year time-period from 2015, to estimate the rate of complications and the outcomes of anterior cruciate ligament (ACL) reconstruction. The target population of this study was the patients referred cruciate ligament reconstruction using hamstring tendon.

Before performing the surgery, written consent was taken from the patients and their physical examination was performed to assess the condition of knee and the general condition of the body.

Inclusion criteria: Age over 18 years, the patient performed the first surgery on the affected knee, the patient had no multiple ligament laxity.

Exclusion criteria: The patients have a generalized ligament laxity, patients with diseases that affect the joint function, patients have a new disease at the time of the surgery until the end of the follow-up and have been referred for the follow-up at certain times. Addiction to any industrial and non-industrial drugs other than cigarettes and opium, and having several ruptures of knee ligaments.

After choosing the qualified patients, obtaining their written consent, and examining the condition of knee and the general condition of the body, the patients, then, were divided into four groups: Smokers (Group A), opium-addicted (Group B), nicotine- and opium-addicted (Group C), and healthy people (Group D). The definition of cigarette smoking is a continuous use of more than three cigarettes per day, and opium addiction means opium consumption of three to five peas at least three days a week.

1-3 days after anterior cruciate ligament reconstruction surgery, all patients were discharged from the hospital with the necessary recommendations and having the same physiotherapy and rehabilitation program.

Additional information includes patient's personal data, age, gender, history of exercise, medical history, severe joints injuries (knee, hip, ankle, knee repair, etc.), the time of occurrence of injury, and a brief history of the injuries occurred.

At the end of the 12th month after the surgery, the KOOS and Lysholm questionnaires were completed by the patients in all four groups in order to measure and determine the severity of symptoms and pain caused by ACL regeneration, the difficulty in daily activities, the difficulty in sports-recreational activities, and the quality of life related to the knee function. Also, the KT-2000 Arthrometer was used for the functional test after 12 months.

An arthrometry device was used to examine the amount of displacement of the tibia plate on the femoral condyles, and as a result of the diagnosis of chronic ACL rupture, defective ACL was defined as a difference of more than 5^{mm} between the healthy side and the affected side. The KOOS questionnaire is a patient-centered questionnaire containing 42 questions that examines 5 patient-related concepts, including pain, other illness symptoms, daily activities, recreational activities, and the quality of life in relation to knee problems. This questionnaire is

a valid and standard questionnaire. The Lysholm questionnaire is also designed to evaluate the results of knee tendon surgery and includes 8 items: Limp, Support, Locking, Instability, Pain, Swelling, Stair Climbing, and Squatting. This questionnaire has been used in many studies to examine the condition of the affected knee. The KT-2000 arthrometry device has been used to test the patient's performance, and its results should be provided at least one year after the surgery. An arthrometry device was used to examine the amount of displacement of the tibia plate on the femoral condyles, and as a result of the diagnosis of chronic ACL rupture, with a difference of more than 5^{mm} between the healthy side and the affected side, which means the affected ACL.

To analyze the data, descriptive statistics method was used to calculate the frequency, mean, and standard deviation, and inferential statistics were used to determine the significant difference between the means of each variable. In the inferential statistics, the Student T-test was used to examine the significant difference between variables. The error

coefficient for all tests was considered as $\alpha \leq 0.05$. Data analysis was performed using SPSS software version 16.

Results

A total of 200 patients participated in this study. The frequency of injuries and their mechanisms are shown in Table 1, which indicates that these data were not significant in the studied groups (P value > 0.05). The mean age in the independent t-test was not significant in the studied groups ($p = 0.9$). Also, there was no significant difference in sex in the studied groups ($p > 0.05$) (Table 2).

Transfer rate based on the KT-2000 device

The displacement rate was measured and graded according to the KT-2000 device. In the statistical analysis, this difference was significant between the non-addicted group and each exposed group (respectively, $p = 0.04$, $p = 0.04$, $p = 0.03$) (Figure 1).

Table 1: Frequency of cause and mechanism of ACL damage

		Frequency	Percentile
Cause of injury	Sports Injury	105	70
	Nondependent to Sports Injury	45	30
Mechanism of Injury	Non - Touch	103	68.6
	Touch	47	31.4

Table 2: The age and sex of the subjects under study

		The Non-accident Group	Exposed Group
Age Average		26.6 ± 5.4	4.7 ± 0.26
Frequency of Gender	Male	(88%) 44	(96%) 144
	Female	(12%) 6	(4%) 6

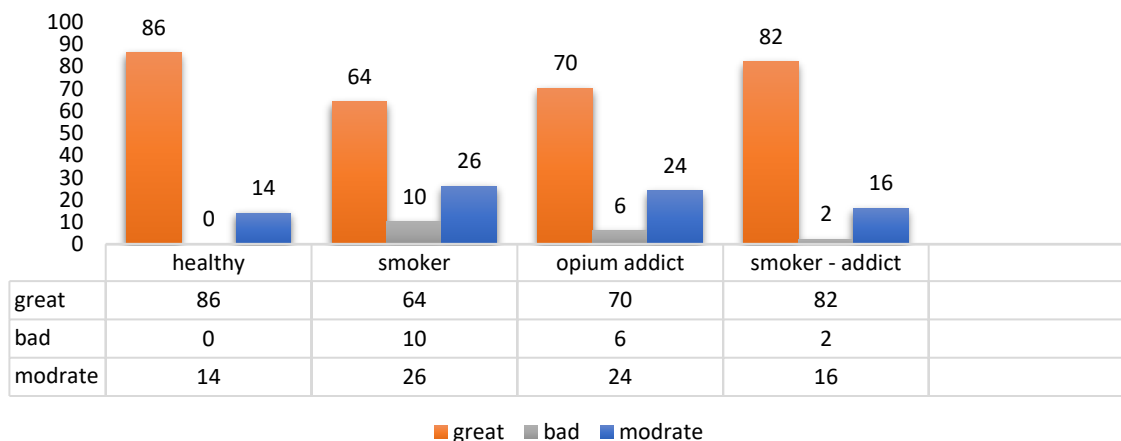


Figure 1: Comparison of the amount of displacement in the studied groups

Evaluation of clinical outcomes based on the KOOS questionnaire:

Knee pain severity

The severity of pain was low in all four groups, but there was no significant difference between the four groups in terms of pain ($P > 0.05$). The amount of difficulty in daily and sports activities was also assessed using a questionnaire. In the statistical analysis, this difference was significant between the non-addicted group and each exposed group ($p = 0.02$, $P = 0.02$, $P = 0.02$).

Similarly, the mean of the difficulty scores of sports activities was significant between the non-addicted group and each exposed group ($P = 0.01$, $P = 0.01$, $P = 0.01$). Moreover, the life quality of the patients was assessed using a questionnaire. This difference was statistically significant between the non-addicted group and each exposure group ($P = 0.04$, $p = 0.04$, $p = 0.03$)(Table 3).

Evaluation of clinical outcomes based on the LYSHOLM questionnaire:

Patients' lameness was evaluated and compared by the Lysholm questionnaire: Support ($P = 0.02$, $p = 0.02$, $p = 0.02$), Instability ($P = 0.01$, $P = 0.01$, $P = 0.01$), Stair-climbing ($P = 0.045$, $P = 0.047$, $P = 0.04$), Squatting ($p = 0.03$, $p = 0.03$, $P = 0.03$).

This difference was statistically significant between the non-addict group and each exposed group. However, the level of locking and swelling of the patients was evaluated using a Lysholm questionnaire. This difference was not statistically significant ($p > 0.05$).

Discussion

The results of the current study generally show that the clinical results of anterior cruciate ligament reconstruction (ACL) in the opium-addicted patients and smokers are significantly weaker than non-addicted patients. The results of following up the patients after 12 months showed that the displacement rate based on the KT-2000 system in the non-addicted group was significantly lower than that in the exposed group. Also, the severity of knee pain, and the amount of difficulty in daily and sports activities based on the KOOS questionnaire in the non-addicted group were significantly lower than the exposed groups (smoker, opium-addicted, and nicotine- and opium-addicted), and the quality of life in the non-addicted group was better than the exposed groups.

According to the Lysholm questionnaire, the score of the patients' lameness, the score of support, the score of instability, the score of stair-climbing, and the score of squatting in non-addicted subjects were significantly higher than each one in the exposed groups, which indicates better clinical results in this group of people. The level of locking and swelling did not differ significantly. Despite the known dangers and frequent warnings, today, more than a billion people are smokers in the world. In addition to the known risks of smoking, including malignancy of various organs, lung disease and cardiovascular disease decreases recently, and instead, the delay in the surgical patients' recovery and the increase of the complications in the consumer have been raised.

Table 3: Average scores of the patients in the KOOS questionnaire

	Healthy	Smoker	Opium	Cigar – opium	P-value
Daily activity	28	43	46	44	0.05>
Sport activities	7	16	14	14	0.05>
Quality of Life	6	11	11	10	0.05>

Table 4: Average scores of the patients in the Lysholm questionnaire

	Healthy	Smoker	Opium	Cigar-opium	P Value
Limping	4.2	3.1	3.9	3.6	0.05>
Support	4.82	4.28	4.32	4.44	0.05>
Locking	12.6	12.4	12.6	12.4	>0.05
Instability	21	17.2	16.8	17	0.05>
Swelling	9.2	8.8	8.9	8.9	>0.05
Stair-climbing	8.9	7.4	7.7	7.5	0.05>
Squatting	4.8	3.6	3.8	3.6	0.05>

On the other hand, few studies have been carried out on the postoperative improvement, especially on the orthopedic surgeries, in the opium-addicted patients. In the studies done by Harvey et al., investigating a cohort of 105 patients, the role of smoking in the delayed Tibia fracture was shown⁽⁶⁾. In addition, in a study conducted by Castillo et al. at Johns Hopkins School, a higher incidence of the complications of tibia open fracture in the smokers was reported⁽⁷⁾. Bydon et al. stated that smokers need to undergo post laminectomy surgery more than non-smokers⁽⁸⁾. A study done by Karim et al. found that the smokers who had been undergoing ACL repair surgery showed weaker functional results regarding the taken tests, and the study predicted that smoking makes the prognosis of the surgery worse⁽⁹⁾. In a systematic review study conducted by Kigganti et al., It was found that in the knee surgery, smoking had a negative effect on the recovery. It also revealed that after quitting smoking, the complications of this surgical intervention would reduce in the patients⁽¹⁰⁾. Kowalchuk et al. reviewed the effective factors in predicting clinical outcomes of ACL reconstruction. This study showed that obesity, smoking, and preoperative cartilage inflammation disrupted significantly the clinical outcomes of patients⁽¹¹⁾. Kaeding et al. also showed that cigarette smoking increases significantly the likelihood of re-rupture of the ACL ligament after reconstitution⁽¹²⁾. So far, there has been no study conducted on the effect of opium on the clinical outcomes of the reconstruction of ACL and it seems – to the best of our knowledge – the present study is the first study in this field. A study carried out by Baqayee et al. revealed that opium-addicted patients have stronger responses to the surgical stress⁽¹³⁾. Another study done by Malwia et al. found that postoperative respiratory, cardiovascular, systemic, and topical complications were higher in the opium-addicted patients than non-addicted ones, and the addicted group showed a higher degree of morbidity⁽¹⁴⁾. In a study conducted by Sung et al., investigating therapeutic results of ACL regeneration in the smokers and non-smokers, it was found that the results of the KT-2000 test were significantly worse in the smoker group⁽¹⁵⁾.

Conclusion

The results of our study confirmed the results of previous studies that the clinical outcomes of anterior cruciate ligament reconstruction (ACL) in the

smokers were significantly more unfavorable than non-smokers and addicts. Also, our study suggests for the first time that the clinical outcomes of this surgery in the opium-addicted patients are similar to the smoker ones. As a result, it is recommended following up the patients with such a risk factor more carefully.

Limitations

Obtaining the patients' satisfaction to participate in the study, and separating the patients into different groups have been some of the limitations of this study.

Acknowledgment

The authors would like to thank the professional team of the Clinical Research Development Unit of Shahid Madani Hospital, Karaj, who helped us in this research.

References

- 1 Lam M-H, Fong DT, Yung PS, Ho EP, Chan W-Y, Chan K-M. Knee stability assessment on anterior cruciate ligament injury: Clinical and biomechanical approaches. *Sports Medicine, Arthroscopy, Rehabilitation, Therapy & Technology*. 2009;1(20):1-9. <https://doi.org/10.1186/1758-2555-1-20>.
- 2 Akoto R, Lambert C, Balke M, Bouillon B, Frosch KH, Höher J. Epidemiology of injuries in judo: a cross-sectional survey of severe injuries based on time loss and reduction in sporting level. *Br J Sports Med*.2018;52(17). <https://doi.org/10.1136/bjsports-2016-096849>
- 3 Gell L, Bühringer G, McLeod J, Forberger S, Holmes J, Lingford-Hughes A, Meier P, editors. What determines harm from addictive substances and behaviours?. Oxford University Press; 2016.
- 4 Najafipour H, Masoomi M, Shahesmaeili A, Haghdoost AA, Afshari M, Nasri HR, Kahnooji M, Samadi S, Mirzazadeh A. Effects of opium consumption on coronary artery disease risk factors and oral health: Results of Kerman Coronary Artery Disease Risk factors Study a population-based survey on 5900 subjects aged 15-75 years. *International journal of preventive medicine*. 2015;6(1):42. 10.4103/2008-7802.157470
- 5 Ardern CL, Taylor NF, Feller JA, Webster KE. Fifty-five per cent return to competitive sport following anterior cruciate ligament reconstruction surgery: an updated systematic review and meta-analysis including aspects of physical functioning and contextual factors. *Br J Sports Med*. 2014;48:1543–1552. <https://doi.org/10.1136/bjsports-2013-093398>
- 6 Harvey EJ1, Agel J, Selznick HS, Chapman JR, Henley MB. Deleterious effect of smoking on healing of open tibia-shaft fractures *Am J Orthop (Belle Mead NJ)*. 2002; 31(9):518-521. PMID:12650537

- 7 Castillo RC1, Bosse MJ, MacKenzie EJ, Patterson BM; LEAP Study Group. Impact of smoking on fracture healing and risk of complications in limb-threatening open tibia fractures. *J Orthop Trauma*. 2005 Mar;19(3):151-157
- 8 Bydon M, Macki M, De la Garza-Ramos R, Sciubba DM, Wolinsky JP, Gokaslan ZL, et al. Smoking as an independent predictor of reoperation after lumbar laminectomy: a study of 500 cases. *J Neurosurg Spine* 2015;22(3):288-293. <https://doi.org/10.3171/2014.10.SPINE14186>
- 9 Karim A, Pandit H, Murray J, Wandless F, Thomas N. Smoking and reconstruction of the anterior cruciate ligament. *Journal of Bone & Joint Surgery, British Volume*. 2006;88(8):1027-1031. <https://doi.org/10.1302/0301-620X.88B8.17189>
- 10 Kanneganti P, Harris JD, Brophy RH, Carey JL, Lattermann C, Flanigan DC. The Effect of Smoking on Ligament and Cartilage Surgery in the Knee A Systematic Review. *The American journal of sports medicine*. 2012;40(12): 2872-2878. <https://doi.org/10.1177/0363546512458223>
- 11 Kowalchuk DA, Harner CD, Fu FH, Irrgang JJ. Prediction of patient-reported outcome after single-bundle anterior cruciate ligament reconstruction. *Arthroscopy*.2009;25(5):457-463. <https://doi.org/10.1016/j.arthro.2009.02.014>
- 12 Kaeding CC, Aros B, Pedroza A, Pifel E, Amendola A, Andrish JT, Dunn WR, Marx RG, McCarty EC, Parker RD, Wright RW, Spindler KP (2011) Allograft versus autograft anterior cruciate ligament reconstruction: predictors of failure from a MOON prospective longitudinal cohort. *Sports Health*. 2010;3(1):73-81. doi:10.1177/1941738110386185
- 13 Wadji MB, Rohban M, Shabani M, Bahrapour A. The effect of Opium addiction on response to major operation stress. *Journal of Kerman University of Medical Sciences*. 2005;12(3):159-164
- 14 Malviya A, Negi N, Mandora M, Yadav J. Perioperative Status and Complications in Opium Addicts in Western Rajasthan. *Indian Journal of Surgery*. 2011;73(5):346-51.
- 15 Sung-Jae Kim, PhD, Su-Keon Lee,y Chong Hyuk Choi,z M Sung-Hwan Kim, Seong-Hun Kim and Min Jung,Graft Selection in Anterior Cruciate Ligament Reconstruction for Smoking ,*The American Journal of Sports Medicine*. 2011;73:346-451. <https://doi.org/10.1007/s12262-011-0324-4>