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The assessment of portal-tract healing after knee arthroscopy

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ABSTRACT

Objective: The aim of this study was to analyse the pattern of portal-tract healing, to compare the healing time of anteromedial and anterolateral portal tracts and to assess the impact of portal-tract delayed healing on the post-operative sub-acute and chronic anterior knee tenderness.

Methods: The study included 104 patients (68 males and 36 females; mean age: 49 ± 3.16 years (range: 17–66)) who have undergone knee arthroscopy. Puncture wounds were divided into two groups, (1) anteromedial and (2) anterolateral groups. Each group contained 104 portal-tracts. Healing of portal tracts was evaluated using sequential superficial ultrasonographic examinations. Visual analogue scale (VAS) was used to measure pain related to delayed tract healing and its association with the post-operative sub-acute and chronic anterior knee tenderness.

Results: Anteromedial and anterolateral tracts total healing time average values were 47 days and 28 days respectively. The VAS average values of anteromedial tracts after 2 weeks, one month, three months, six months and one year were 8.2, 6.3, 4, 1.9 and 0.6 respectively, and for the anterolateral tracts 7.4, 5.5, 2.8, 1.2 and 0.2 respectively. A statistical significance was detected between the two groups at the first and third months with P values 0.042 and 0.0035 respectively.

Conclusions: Anteromedial tracts closed later than anterolateral tracts. Both portal-tracts delayed closure is a potential for post-operative sub-acute and chronic anterior knee tenderness after arthroscopic surgery. Four grades of tract healing were recognized. Portal-tract ultrasonography is advised in persistent post-operative sub-acute and chronic anterior knee tenderness.

Level of evidence: Level III, Therapeutic study.

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Introduction

The number of arthroscopic knee procedures have been increased tremendously within the last decade. In knee arthroscopic surgery two classical skin punctures are used to allow surgeon to examine and treat joint lesions. The skin portals (anteromedial and anterolateral) are closed with simple stitches to minimize the probable formation of an iatrogenic dead space, to lower the risk of bleeding and to lower the risk of infection.¹ Many suturing techniques have been introduced to close portal-tracts, however the most commonly used closure techniques are the regular nylon mattress and the simple stitches.² Post-operative

portal-site pain is known to disturb immediate rehabilitation and may seriously affect patient's comfort.³ Ultrasonography (USG) has been used successfully in the diagnosis of many musculoskeletal pathologies, it has been considered as a trustable modality of diagnosis by many orthopaedic surgeons.^{4–7}

Our hypothesis before submitting this study was that, anterolateral portal-tracts heal earlier than anteromedial portal-tracts.

The purpose of this prospective study is three-fold; to assess the pattern of both anteromedial and anterolateral portal-tracts healing process, to compare the time required for complete healing of both anteromedial and anterolateral portal tracts and to document the impact of delayed portal-tract healing on the post-operative sub-acute and chronic knee tenderness.

Patient and methods

169 patients underwent knee arthroscopy for simple therapeutic and diagnostic purposes in the period of January 2013 to

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June 2014. The inclusion criteria of this study were, active mobile patients, patients without chronic diseases that may disturb wound healing process like diabetes mellitus and chronic obstructive lung disease and patients with neither X-ray signs of moderate to advanced knee osteoarthritis nor with knee mechanical axis deviations. Whereas all patients with radiological signs of moderate to advanced knee osteoarthritis, patients required prolonged arthroscopic procedures like ACL reconstruction, meniscus repair, mosaic arthroplasty and patients with certain conditions that may delay wound healing like diabetes mellitus, chronic obstructive lung diseases, coronary heart diseases and cigarette smoking were excluded from the study. 117 patients were remained, 11 of them were missed during the follow-up period and 2 patients developed superficial wound infection, were excluded from the study. The remaining 104 patients were eligible for the final analysis. The average age of the patients involved in this study is 49 ± 3.16 years (range; 17–66), consisted of 36 females and 68 males with an average body mass index (BMI) of 34 ± 4.74 kg/m². All knee arthroscopies were performed by one surgeon. All patients were admitted as day cases. The average follow-up period was 12.4 months. All patients were called for followed up at one week, two weeks, one month, three months, six months and twelve months. The demographic data of the patients and the types of knee arthroscopic procedures of patients involved in this study were explained in (Table 1). The patients were evaluated clinically and radiologically before surgical interventions. Surgical indications for the arthroscopic procedures of the patients involved in the study were explained in detail in (Table 1). The main aim of this study was to assess the healing time required for the most commonly used portal tracts in knee arthroscopic surgery; the anteromedial and the anterolateral portals which have different localizations, and to evaluate the impact of the delayed healing of portal tracts on the post-operative sub-acute and chronic knee tenderness. Portal tracts were divided into two groups according to their localization around the patellar tendon, the anteromedial (group 1) and the anterolateral (group 2). All arthroscopic procedures were carried out using only the classical anteromedial and anterolateral portals. Portal punctures were made oblique, pointing to the intercondylar notch, 1 cm above the joint line and 1 cm away from the patellar tendon. Skin puncture was made with number 11 sharp blade. A blunt 4 mm trocar was used in all procedures. All of operations were performed under regional anaesthesia. A 30-degree 4.0 mm arthroscopic optic was used in all cases. All portals were closed with simple stitches. Hemovac drains were not used and all patients were allowed to mobilize immediately with full-weight bearing when possible after the procedure. Stitch removal was made at the out-clinic after two weeks for all patients. Ultrasonography (USG) has been described by variant studies^{4–6} to be sensitive in detecting superficial soft tissue pathologies. USG has

Table 1
Demographic characteristics of patients who underwent knee arthroscopic procedures and surgical indication for knee arthroscopy.

Data	
Total no. of patients	104
Male (n)	36
Female (n)	68
Average age (y)	49 ± 3.16
Average BMI (kg/m ²)	34 ± 4.74
Indications (n)	
Medial meniscal tear (partial meniscectomy)	71
Medial meniscal tear (total meniscectomy)	3
Lateral meniscal tear (partial meniscectomy)	9
Medial femoral condyle cartilage lesion	11
Lateral femoral condyle cartilage lesion	2
Synovectomy and plica resection	8

been used in our study as a diagnostic tool to assess the pattern of portal-tract healing, the period required for tract healing for both portal-tracts and the impact of portal-tract healing grade on post-operative sub-acute and chronic knee tenderness. All portal-tracts were examined by superficial USG by the same radiologist at each follow up.

Two groups of portal tracts (anteromedial and anterolateral), were evaluated during our study period. Each group contains 104 portal-tracts. No additional portals were needed for any case. Throughout the follow-up period from two weeks to one year, the post-operative USG revealed four different grades of tract healing pattern in the knee joint (Fig. 3). Fig. 3D demonstrates grade (0) where the tract is totally open, Fig. 2C demonstrates grade (1) where the tract is partially healed, Fig. 3B demonstrates grade (2) where the tract is healed subtotally, whereas Fig. 3A demonstrates grade (3) a total healing of tract.

Resting tenderness related to portal-tract incomplete healing was evaluated by direct pressure on the puncture wounds. All patients were asked to quantify the tenderness at the portal-tract according to the visual analogue (VAS) scale which is considered as a valid measure of acute pain with a good construct validity.⁸

The Mann–Whitney-U Test was used for statistical evaluation of the collected data. The level of significance was set as $P < 0.05$.

Ultrasonographic examination protocol

The HD 15 pure wave (Ultrasound system, Philips) US apparatus was used for the study, equipped with a 12 L linear transducer, with a frequency of 12 MHz. The patients were in a supine position with legs being straight. USG protocol was mainly focused on the portal-tract area to detect the healing grade of each tract at every follow-up session (Fig. 1). Superficial USG clearly demonstrates the anterior anatomy of the knee joint (Fig. 2).

Results

The average value of the anteromedial portal-tract healing time was 47 ± 92.21 days (range; 15–386), two tracts remained partially opened after 1 year; one of which was with grade 1 and the other was with grade 2. Whereas the average value of the anterolateral portal-tract healing time was 28 ± 65.73 days (range; 15–180). Anterolateral tracts heals earlier than the anteromedial tracts, the difference of tracts healing time was statistically significant with a P value of 0.018.

The averages VAS values of anteromedial tracts after 2 weeks, one month, three months, six months and one year were (8.2 ± 6.44 , 6.3 ± 4.87 , 4 ± 3.26 , 1.9 ± 2.59 , 0.6 ± 2.16) respectively, and (7.4 ± 3.29 , 5.5 ± 4.73 , 2.8 ± 3.14 , 1.2 ± 2.83 , 0.2 ± 1.19) for the anterolateral tracts respectively.

Two weeks after the arthroscopic standard surgical technique, high average values of VAS scores were recorded in both groups with no statistical significance was documented, P value (0.164). However after one and three months of the surgical procedure, minimal drop of the average VAS score values was recorded in both groups. The anteromedial tract group had a greater average VAS score value (6.3) compared to that of the anterolateral tract group (5.5) after one month of the surgical procedure, a statistical significance was detected between the two groups with P value (0.042). After three months the VAS average score value of the anteromedial tract group was (4), which was higher than that of the anterolateral tract group (2.8), a statistical significance was detected between the two groups with P value (0.0035). After six months and one year of the standard surgical technique, an obvious drop of the average VAS score values was noticed in both groups. The average VAS score value of the anteromedial tract group was higher

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