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ORIGINAL ARTICLE

Pie-crusting technique is effective and safe to release superficial medial collateral ligament for total knee arthroplasty

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Received 7 October 2017; received in revised form 9 January 2018; accepted 9 January 2018

KEYWORDS

Pie-crusting;
Soft tissue balance;
Superficial medial collateral ligament;
Total knee arthroplasty

Abstract *Background:* Pie-crusting technique is a damage-control soft tissue balance skill of total knee arthroplasty (TKA). The outcome of this technique to release lateral soft tissue is reasonable. A limited number of studies have focused on medial collateral ligament release with pie-crusting technique in the past years because of concerns about its efficacy and safety. *Method:* All cases underwent superficial medial collateral ligament (SMCL) release with either pie-crusting technique or traditional technique (39 knees in each group) between January 1, 2014 and September 31, 2015. A comparison study between two techniques was performed; meanwhile, 23 patients (26 knees) in pie-crusting group were followed up. Data including knee function, radiographic result and complications were analysed.

Results: Comparison study demonstrates that pie-crusting technique can achieve a comparable or even better effect of alignment correction. Data of follow-up patients are reasonable. The mean postoperative flexion contracture is $1.2 \pm 3.6^\circ$. The mean postoperative motion arrange is $104.0 \pm 14.4^\circ$. The mean postoperative hospital for special surgery knee score point is 82.0 ± 7.4 points. The mean postoperative femoral tibial angle is $172.4 \pm 2.0^\circ$. The level of joint line elevates around 2.1 ± 1.9 mm. There are four knees that use brace after operation, and none of them present unstable knee. No severe complication has been reported, and most patients were satisfied with life quality.

Conclusions: Using pie-crusting technique to release SMCL for TKA is effective and safe.

Translation point: Although pie-crusting technique has been used in TKA for years, it is seldom chosen to release medial collateral ligament, especially to release SMCL, which is a vital step

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<https://doi.org/10.1016/j.jot.2018.01.001>

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Please cite this article in press as: He X, et al., Pie-crusting technique is effective and safe to release superficial medial collateral ligament for total knee arthroplasty, Journal of Orthopaedic Translation (2018), <https://doi.org/10.1016/j.jot.2018.01.001>

of malalignment correction. This study aims to evaluate the efficacy and safety of this technique so that it can benefit patients.

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Introduction

Malalignment of lower extremities can usually be corrected after osteotomy of femur and tibia in total knee arthroplasty (TKA), while some cases still present an unbalanced joint gap, which may be caused by chronic soft tissue disease, trauma and iatrogenic impairment [1–4].

To correct an unbalanced joint, different soft tissue release techniques were developed. Among these techniques, traditional release technique, which is also called Insall release technique, has become a popular method to release contracture soft tissue with an acknowledgeable clinical outcome reported by sufficient studies [1,5–8]. However, some studies also show their concerns about complications brought by this technique, which include unstable knee due to overrelease, elevation of joint line, which may affect track of patella and haemarthrosis caused by periarticular arterial injuries [4,9–12].

As a damage-control method, pie-crusting technique is translated from arthroscopy surgery, and it aims to reduce complications of arthroscopic operation [13,14]. At first, this new technique is usually performed to release lateral tissue for patients who suffer a stiff iliotibial tract or lateral collateral ligament [15–19]. Compared with lateral knee, releasing medial soft tissue can make a much greater biomechanical contribution to keep whole system stable [6]. Recently, a few studies focus on medial collateral ligament release with pie-crusting technique and report comparatively inspired clinical results [20–23].

In this study, we release superficial medial collateral ligament (SMCL) with pie-crusting technique and evaluate it in both clinical effect and safety perspectives. A comparison study between traditional technique and pie-crusting technique as well as a short-term follow-up study for pie-crusting release cases are involved. We expect our study can demonstrate that releasing SMCL with pie-crusting technique is effective and safe.

Patients and method

Patients

All patients underwent TKA between January 2014 and August 2015. All operations and perioperative tests were taken in Peking University Third Hospital.

Pie-crusting group includes 36 patients (10 males and 26 females) with 39 knees. Average age is $66 \pm 8.7Y$ (48–86Y) and mean height, weight and body mass index (BMI) are 1.57 ± 0.10 m (1.47–1.80 m), 71 ± 11.3 Kg (58–111 Kg) and 28.8 ± 3.9 kg/m² (22.4–34.3 kg/m²), respectively. As for cases in traditional release group, 38 patients (4 males and 34

females) with 39 knees are involved. Average age is $67 \pm 6.4Y$ (54–78Y), and corresponding mean height, weight, BMI are 1.54 ± 0.15 m (1.41–1.69 m), 71 ± 17.8 Kg (43–101 Kg) and 28.1 ± 4.8 kg/m² (16.6–39.5 kg/m²), respectively.

In pie-crusting release group, 29 patients (32 knees) who underwent release with a release scalpel (a curve-handle is designed that blade can be kept perpendicular to ligament tissue when releasing) were followed up after TKA. After a period of 10.4-month follow-up, data of 23 patients (8 males and 15 females) with 26 knees were collected, and all cases were diagnosed as osteoarthritis except 1 knee (rheumatoid arthritis). At the terminate point, data of 6 patients were excluded (4 patients lost contact, 1 patient suffered a severe low back pain because of lumbar disc herniation and 1 patient was unfortunately diagnosed with breast cancer), and data of 23 patients with 26 knees were validated (Picture 1).

Surgery procedure

Genesis II posterior stabilised high flexion implants (Smith and Nephew, London, UK) was used in all cases.

After tourniquet is inflated, articular was exposed with a standardised medial parapatellar approach. Patella was dislocated, and infrapatellar fat pad was dissected. Anterior cruciate ligament and residue meniscus was dissected, and patella tendon was released. Femur osteotomy with a valgus cut of 6° was performed with protection of both lateral and medial collateral ligaments. Tibia osteotomy was performed with a posterior tilt cut of 3° after dissection of posterior cruciate ligaments. The data of removed bone thickness of distal femur and proximal tibia were collected, and size of prosthesis is measured. A spreader was inserted into joint gap to evaluate soft tissue condition. If joint gap presented unbalance with a narrow medial gap, SMCL would be released with pie-crusting technique or traditional release technique (details will be described in next section). Femoral and tibial component would be installed after obtaining a balanced joint gap and component sizing confirmation. An appropriate plate would be inserted between components. Then, stability and motion of knee with both flexion and extension was reassessed and confirmed. If medial tissue remained contracture, posterior–medial capsule would be released. Both components were fixed with bone cement. Patella surface was remolded without installing patella component. Closure procedure was performed with standard method.

Release technique

SMCL was released in all cases of this study. For pie-crusting technique, 3 to 5 small incisions at mid-substance of ligament were pricked by a scalpel or a needle, and contracture gap would be released gradually with a spreader

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