Techniques and Outcomes of Medial Soft Tissue Release for Moderate to Severe Varus Deformity in Total Knee Arthroplasty: A Literature Review

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Total knee arthroplasty for osteoarthritic knee with severe varus deformity always requires medial soft tissue release to reach a perfect outcome of the surgery. Up until now, there is still no consensus for the best technique of medial soft tissue release. This literature review collected and compared some aspects of each proposed techniques. The data were recruited from the PubMed and Google Scholar. The authors chose six medial soft tissue release techniques to be reviewed. These included subperiosteal release of superficial medial collateral ligament, pie-crusting technique, multiple needle puncture technique, medial epicondylar osteotomy, femoral origin release of the medial collateral ligament, and semimembranosus release. The results showed that each technique had a distinct superiority to each other. Each technique may be preferred in some situations. After a thorough discussion, the authors preferred the conventional subperiosteal release of superficial medial collateral ligament technique.

Keywords: *osteoarthritic knee, varus deformity, total knee arthroplasty, medial soft tissue release*

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Introduction

Total knee arthroplasty (TKA) has been considered as a standard treatment of osteoarthritic (OA) knee[1]. To reach a point of well-functioning TKA, a neutral mechanical axis is needed[2]. However, in some osteoarthritic knees, varus deformity is always found, therefore, medial soft tissue release is necessary in those cases. While conventional subperiosteal release of superificial medial collateral ligament (sMCL) technique proposed by Insall et al.[1,3] has been commonly used by many surgeons, there have been numbers of modified methods proposed to reach a target medial soft tissue balance[4-8]. However, these new methods have still been controversia[l9].

The purpose of this literature review was to collect the up to date data on the conventional and alternative medial soft tissue release techniques in terms of individual surgical technique and related outcome.

Material and Methods

Initially, the fundamental knowledge of total knee arthroplasty was reviewed from conventional textbooks, review articles, and some studies published online. A total number of six techniques for medial soft tissue release in TKA was selected to be further reviewed and discussed in this literature review. These included conventional subperiosteal release of superficial medial collateral ligament, pie-crusting, multiple needle puncture, medial epicondylar osteotomy, femoral origin release of the medial collateral ligament, and semimembranosus release. More publications were recruited to be reviewed in detailed by online searching. The online databases used in this literature review was PubMed. The search strategy was conducted to recruit publications that contain either one of those selected techniques for total knee arthroplasty. The search term for total knee arthroplasty included "total knee arthroplasty," for general published data and "replacement, total knee" as MeSH Terms. For conventional subperiosteal release of superficial medial collateral ligament, the search term included "subperiosteal," and since most publications usually used other terms to mention "subperiosteal release technique," we also used "complete release," "complete detachment," and "over-release". For pie-crusting technique, the search term included "pie-crusting," and "pie crust*." For multiple needle puncture technique, the search term was "multiple needle punctur*." For medial epicondylar osteotomy technique, the search term was "medial epicondylar osteotomy." For femoral origin release of the medial collateral ligament technique, the search term was "femoral origin release." For semimembranosus release, the search term was "semimembranosus release." The searching was conducted on April 14, 2019. The search term for this review was: ((total knee

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arthroplasty) OR replacement, total knee[MeSH Terms]) AND ((subperiosteal) OR (complete release) OR (complete detachment) OR (over-release) OR (pie-crusting) OR (pie crust*) OR (multiple needle punctur*) OR (medial epicondylar osteotomy) OR (femoral origin release) OR (semimembranosus release)). The inclusion criteria were 1) publications that were published in English language 2) the knees in the publications were varus deformity with any severity 3) the techniques used for medial soft tissue release in the publications were relevant to those six techniques mentioned in this literature reviews. Firstly 157 publications were found. After reading the abstracts, 28 publications were included. At final, 15 publications remained for this literature review after reading a whole article in detailed. These 15 publications were used in the result part of this literature review. More publications considered by the author's opinion and experiences to be beneficial were added into the introduction and discussion part of this review. Finally, there were 26 publications sited in this review.

Results

Subperiosteal release of superficial medial collateral ligament

Technique: This technique was first described by Insall et al.[1] A chisel or osteotome is used to completely release distal insertion of medial collateral ligament. Whether to release pes anserinus or not depends on the severity of the imbalanced gap. The crucial point is to keep the continuity of periosteal sleeve.

Outcome: After subperiosteal release technique has gained popularity among many surgeons, there has been a few reports on clinical outcomes related to this technique of medial soft tissue release, whilst there has been some concerns over the outcome of the over-release of medial soft tissue following the raising complications after repairing of the injured or disrupted MCL. In 2009, Koo et al.[10] evaluated the clinical and radiological results of knees that underwent subperiosteal release of MCL which were left conservatively untreated compared to those of knees with intact MCL. The results showed that there was no significant difference in the outcomes of both clinical and radiological. Also, at the 2-year follow-up, there was no case of joint instability in the group of subperiosteal release.

Similar to Koo's study, in 2014, a series of mid-term clinical outcome of subperiosteal release technique of MCL in TKA was reported by Prateeptongkum et al.[11] With a mean 6-year follow-up, this study raised an attention to prove the mid-term clinical outcomes and knee stability following intentionally complete release of intact sMCL. It showed that more than 80% of the knees with conventional subperiosteal technique were defined as stable knee joint. Even though, they found that there was a high incidence in the thickness of polyethylene insert used which also had an effect on postoperative elevation of joint line, they stated that this had nothing to do with the joint stability.

In 2015, another study of Cho et al.[12] came out to insist that complete release of the MCL does not lead to laxity of the joint. They compared the amount of medial joint gap opening in valgus stress radiographs in the complete release and partial release groups of subperiosteal release of MCL. The findings showed that the mean value of the joint opening on the valgus stress test were not statistically significantly different in both groups.

In 2018, Choi et al.[13] also analyzed the outcomes of the over-release of ligament by subperiosteal release technique. The clinical outcomes and the survival of the implanted in patients who underwent subperiosteal release with over-release MCL and received no treatment were compared to those of intact MCL knees. They found that the knee society score and knee functional score in the over-release group were not significantly different from the group of intact MCL. Also, the study found no medial instability at their last follow-up which was conducted annually ranging from 60-149 months.

Pie-crusting technique

Technique: Pie crusting technique was firstly described by Aglietti et al.[14] for balancing the tight lateral collateral ligament in valgus deformity of knee osteoarthritis. Later on, this technique has been applied to use in varus arthritic knees in order to achieve a balanced gap in the tight of superficial medial collateral ligament[8,15,16]. In 2009, Verdonk et al.[8] proposed that the proper mechanical axis of the knee joint could be achieved irrespective of this technique. They followed the algorithm used by an experienced surgeon in their teaching hospital. The algorithmic approach included a second step of pie- crusting technique. After an insertion of the laminar spreader, the tip of the blade is used to release the tight fiber. Anterior portion release of the ligament affects the flexion gap whereas posterior portion release affects the extension gap.

Outcome: There have been limited publications regarding the clinical outcomes of this technique. In 2009, according to Verdonk et al.[8], they compared the first group that underwent pie-crusting technique with the second group that underwent distal release of the sMCL. The results showed that there was no significant difference in the mean value of hip-knee-ankle (HKA) angle postoperatively between the two groups. There was also no significant difference between two groups in both total scores and subscores of mediolateral

instability with international knee society (IKS) score.

In 2016, pie-crusting technique has come into the spotlight for its advantage for severe varus deformity OA knee. Ha et al.[17] studied the effectiveness and safety of the pie-crusting technique during primary TKA. They retrospectively reviewed prospective study of 729 primary TKAs. The protocol described different techniques used in two types of the pathological knees. For medial tightness in flexion, traditional subperiosteal stripping for the anterior portion of the MCL was performed. For medial tightness in extension, pie-crusting of the tight fibers in the posterior portion of MCL was performed. The results showed that there was no patient with medial instability on the manual valgus-varus stress test of the knee at the last follow-up visit. No other specific complications related to the pie-crusting technique, such as nerve injury, hematoma formation, bleeding, or conversion to a constrained prosthesis related to over-release were found. They also suggested that a mediolateral gap imbalance (medial tightness) in extension up to 10 mm can be effectively corrected by the pie-crusting method, which was contrary to the past researches that suggested pie crusting technique for a lower level of gap imbalance.

In the same year, Mehdikhani et al.[18] criticized about the cost of constrained TKA construct and reported a retrospective review studying the need for a constrained insert for residual intraoperative instability in two groups between the conventional subperiosteal release technique and pie crusting technique. The results showed that the use of constrained insert was significantly lower in the pie-crusting group than in the conventional group. There was also no significant difference in functional knee society system (KSS) clinical score, KSS function score, and range of motion (ROM).

Although pie-crusting had been gaining more popularity, there were still few studies focusing on the clinical results. The current study of He et al.[19] on the clinical effect and safety perspective comparing between the conventional subperiosteal release technique and the pie crusting technique showed that the pie crusting group had a smaller postoperative femorotibial angle (greater valgus degree). Pie crusting also had a greater tibial osteotomy volume and plate thickness in which these two factors depended on the severity of the joint damage. Therefore, the author suggested that pie-crusting technique can be applied for a more severe joint damage.

Multiple needle punctures

Technique: Multiple needle puncture (MNP) technique was first introduced by Bellemans et al.[7] This technique releases the tensed fiber of medial collateral ligament while valgus force is applied. According the pioneers, a 19-gauge needle is used to perpendicularly pierce the tensest fibers while the knee is stressed in valgus. Punctures are performed with a gap of 3 to 5 mm, proximally toward distally and anteriorly toward posteriorly. The fiber tightness can be detected by distraction spreader before bone cut. Alternatively, it can be done after bone preparation and insertion trial component.

Outcome: In 2010, while some surgeons believed that pie crusting technique which performed by stabbing incisions could be a risk for iatrogenic transection of the MCL, Bellemans et al.[7] presented a safer technique using a needle instead of the blade, so called "Multiple needle punctures". They performed a prospective study of 35 osteoarthritis knees with varus deformity which underwent multiple needle punctures in MCL. Their results showed that 34 out of 35 (97%) of cases had a successful correction of medial tightness while one case was considered over-released in extension. During follow up, no complications or signs of clinical instability were noted. Mechanical alignment as measured on standing full leg radiographs improved from 12.5 degrees of anatomical varus to 0.6 degree of anatomical varus. The average knee society score improved from 41 points, preoperatively, to 93 points at final follow up. The average functional score improved from 37 points, preoperatively, to 83 points at final follow up. The average flexion improved from 112 points, preoperatively, to 116 points at final follow up. Full extension of the knee was restored in all but 2 cases.

Ohmori et al[20] established the relationship between the number of needle puncturing and the amount of change in the balance of medial and lateral sides in flexion and extension positions of knees. They conducted the study on cadaveric knee. A needle size of 18 G was punctured into the stretched MCL from inside-out in a 90-degree flexion position. The MCL was punctured 0, 10, 20, 50, 75, and 100 times. The result showed that MNP technique affected knee in flexion more than in extension. Each 10 times of puncturing produced 0.6 mm release in flexion and 0.1 mm release in extension.

Although there were few reports of over-release cases in the technique of multiple needle punctures, Koh et al.[21] evaluated the quantitative effects of MNP technique on gap increasing information in order to point out the risk factors for over-release. They performed a cadaveric study which used 10 pairs of cadaveric knees. One knee from each pair underwent multiple needle puncture technique in extension (E group). Other knee in each pair underwent multiple needle puncture in flexion (F group). The results showed that both medial extension and flexion gaps gradually

increased after every five needle punctures in both groups. All extension and flexion gaps in both groups increased significantly compared to those associated with the previous five needle punctures, excluding the flexion gap change between 15 and 20 punctures in the F group. When puncturing was done with the knee in flexion, the flexion gap increased more selectively than the extension gap. When performed in extension, the extension gap did not increase more than flexion gap. The study also showed the predictors for the lower number of MNPs required for over-release which were knee in flexion, narrow MCL, severe OA. The authors also suggested that a pathologic fibrosis, severe contracture of medial soft tissue structures that required more than 5 mm of medial gap release contributed to a risk of transection or mechanical failure of the MCL during MNP, therefore, a traditional subperiosteal release of MCL might offer more efficient medial gap release in knee with severe varus deformity[8].

Medial epicondylar osteotomy

Technique: Medial epicondylar osteotomy technique is simply performed using a chisel. The osteotomy is made in the direction of distal to proximal along the long axis of the femur. The osteotomised fragment, which is attached by the MCL, is then slid down toward distal direction until the equal gap balancing in both extension and flexion positions are achieved. To reattach the medial epicondyle, non-absorbable suture materials are used after implantation component.

Outcome: In 2013, Sim et al.[22] performed a retrospective study to compare the results of conventional subperiosteal technique with those of medial epicondylar osteotomy during ligament balancing in varus knee TKA. The results showed that there were no differences in clinical outcomes which included knee score, functional score, and ROM between the two groups. However, for the medial stability performed on the valgus stress radiograph compared with the contralateral side, difference was found to be higher in medial epicondylar osteotomy group than the group with conventional Insall technique.

Femoral origin release of the medial collateral ligament

Technique: Femoral origin release of the MCL is proposed by Lee et al.[23] as a novel medial soft tissue release. The technique is performed with the knee in flexion position and the MCL insertion is identified and then its width is measured. The stepwise release is performed by using a blade No.11. Each increment of the release is approximately 1/3 of the MCL width. The release is performed until the mediolateral gap becomes well balanced.

Outcome: According to Lee et al.[23] who performed a retrospective review of the femoral origin release of the medial collateral ligament (FORM), the results showed that all knees could achieve a target alignment, and the hip-knee angle (HKA) changed from 166±8 degrees, preoperatively to 180±2 degrees, postoperatively. The degree of valgus instability was found i 43 knees at postoperative 12 weeks as grade II then resolved to grade I at 24 weeks. The KSS clinical score, KSS function score, ROM significantly improved from those of preoperative evaluation.

Semimembranosus release

Technique: Semimembranosus release technique is performed with the knee in flexion position. The semimembranosus tendon is released at the tibial insertion by using a blade or an electrocautery. The posteromedial tibial insertion of the tendon is completely release by a periosteal elevator. While over-release problem has not been solved clearly, semimembranosus release technique has shown to have limited clinical data for its effect. Koh et al.[24] proposed to use algorithmic approach to minimize the risk of over-release, whilst Kim et al.[25] and Jang et al.[26] proposed sequential release, including step 1: subperiosteal release of deep MCL, step 2: semimembranosus release, and step 3: MNP of superficial MCL.

Outcome: In 2013, according to Koh et al.[24] in a prospective study of semimembranosus release as a second step of the sequential release, they reported that the medial gaps were significantly increased after semimembranosus release compared to pre-release status. Lateral gaps were also significantly increased after semimembranosus release except for in full extension position. No patient showed mediolateral instability on manual maximal valgus-varus stress test with knee in extension and flexion at final follow-up. The mean KSS clinical score improved from 39 points, preoperatively, to 93 points at final follow up. The mean KSS function score improved from 53 points, preoperatively, to 89 points at final follow up. Mean ROM improved from 120.8 degrees, preoperatively, to 130.1 degrees at final follow up.

In 2015, Kim et al.[25] reported that sequential release of semimebranosus provided sufficient medial soft tissue tension over time after the procedure without the risk of instability or delayed rupture of the medial structures. According to 3 groups of patients who underwent sequential 3 steps of release to reach a target gap balance, results showed the significant improvement in preoperative knee alignment and mechanical axis among the 3 groups, and more steps were required to obtain a balanced gap in cases of more severe preoperative varus deformity with no significant

differences in postoperative knee alignment, KSS clinical and function scores, and Western Ontario and McMaster Universities Arthritis (WOMAC) score at the 12-month follow-up between the 3 groups. There were no significant differences in the postoperative medial laxity at the 3, 6, 12 months follow-up. And the differences of lateral gap laxity disappeared at 12 months follow-up in all groups. They concluded that it could be inferred that semimembranosus release as the second step of the sequential release could be enough in some knees depending on their severity of varus deformity.

In 2016, Jang et al.[26] prospectively studied 59 knees with 3-step sequential release of medial soft tissue to determine whether semimembranosus release to balance the medial soft tissue decreased knee flexion strength after TKA. There were 31 knees that reached the target balance within the first step. Other 28 knees further required step 2 to reach the target gap balance. The analysis of the two groups revealed that there were no differences in knee flexor or extensor peak torque, no differences in medial joint opening angle on valgus stress radiographs, no differences in knee society or WOMAC score.

Discussion

This literature review has some limitations. Firstly, since there is no uniform method of medial soft tissue release described in the literature and most studies could not performed a high level of study according to the evidence-based medicine, we could not conduct a randomized control trial to evaluate the effectiveness of all methods. Thus, we could only collect the most relevant data of each method as secondary data and then compare them with each other. Secondly, there were some uncontrollable variations in most studies which could affect the outcomes of each method, including the experiences of the surgeons, the approaches of the surgery. However, we believe that this review article was performed based on a decent and relevant format of literature search.

Subperiosteal release of superficial medial collateral ligament

This classic technique can be considered as mile-stone technique for medial soft tissue release, as it has been widely used by several surgeons and it has always been compared to the newly proposed techniques. In fact, a subperiosteal release technique releases the ligament-bone insertion. Therefore, over release of the medial structures is usually not encountered since this technique maintains the continuity of the tissue with the periosteum. Furthermore, some additional techniques can be performed along with subperiosteal stripping to monitor the extent of the release, for example, placing the knee into full extension then exerting a valgus force, or the usage of the lamina spreaders. With progressive subperiosteal release of the MCL, this technique can be considered as predictable and durable[15]. However, if accidental over-release occurs, the risk of progressive medial laxity is less likely, as the MCL is known to be one of the ligaments that have a good healing potential.

Compared to the newly proposed techniques of medial soft tissue release which cause relatively a mid-substance injury to the MCL, the MCL the injury following the subperiosteal release occurs at the distal portion of the ligament, which may provide a more rapid time to be healed[8,16]. However, the instability of the knee with this method has become the major disadvantage, which can result in lift-off phenomenon and eccentric polyethylene wear at later on[9].

Pie-crusting technique

Pie-crusting technique avoids the ligament-bone insertion complications, as it focuses the release on the mid-substance of ligament. According to its stair-step technique[5], it provides a better control in over-release of the medial soft tissue. This technique is also performed in the pattern of inside-out technique, hence it avoids neurovascular injury. Although this technique has been claimed to correct up to 10 mm of mediolateral gap in extension[6], it is nearly impossible for the surgeons to control the depth and angle of each pie-crust.

Multiple needle puncture technique

This technique was adapted from pie-crusting technique[7]. It is shown to have advantages in a more progressive and controlled release. Surgeons can control the depth of each puncture with the tip of the needle. However, MNP may not be successful in cases with more severe deformity because of the increased fibrosis of the medial soft tissues.

Medial epicondylar osteotomy

This technique is showed to be useful in a knee with severe combined varus and flexion contracture[14]. The continuity of the proximal to the distal MCL and adductor magnus tendon provides knee stability in technique[9]. Since the healing in this technique is bone-to-bone healing, it may provide a better healing environment. Some disadvantages of this technique include fibrous union which was observed in several cases. In the worst-case scenario, heterotopic ossification can also occur. A delicate control of medial release cannot be achieved with this method which can cause complete detachment of the femoral insertion of the MCL[10].

Femoral origin release of the medial collateral ligament

The concept of this technique was based on the basis healing process. Abundant blood supply in the condylar area provided a better healing potential. A femoral origin of MCL is narrower than a tibial insertion so it requires a narrower region of healing process[10]. Since the release does not have to deal with the mid-substance of the ligament, it can be performed in knees with severe varus deformity. However, more studies are needed to be done to confirm its safety and efficacy.

Semimembranosus release

The semimembranosus tendon has a complex attachment and the area in which the tendons blend with the posteromedial aspect of the tibia and posterior capsule is targeted for release. The concept was that release of the broad posteromedial expansions of the semimembranosus may play a role in widening of both medial and lateral side. And the results showed that significant increases in the joint gaps both medially and laterally except for in the lateral extension gap[11]. This release technique avoids unnecessary release. However, its weak point is that it needed to be performed in conjunction with other techniques.

Author's preferred technique

The authors have always chosen to perform conventional subperiosteal release technique for medial soft tissue release. According to our mid-term clinical outcomes of the TKAs with conventional Insall subperiosteal release technique[11], it provided no further attenuation of the sMCL. However, in most cases, the use of thicker polyethylene insert was inevitable in order to balance the released medial gap with the lax lateral gap. Although the thicker polyethylene used lead to an elevation of joint line, this had no effect to a range of motion of the knee joints. At the mean 6-year follow up, comparing between the group with releases and without release, there were similar outcomes, including KSS clinical and functional scores, knee stability, and radiographic evaluation. These are the supporting reasons why our institute had considered conventional Insall technique as a superior method to other alternative ones.

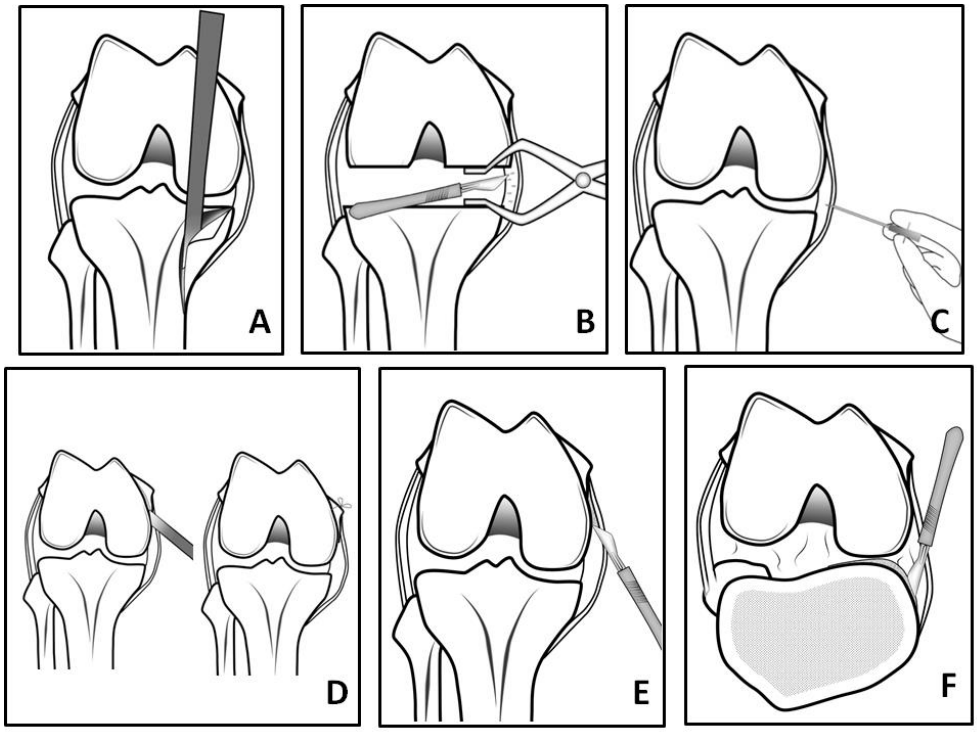

Fig.1 Drawing pictures demonstrating each surgical technique of medial release in TKA.

A: Complete release of medial supporting structure by subperiosteal technique

B: Pie crusting technique

C: Multiple needle punctures technique

D: Medial epicondylar osteotomy using chisel and suture with non-absorbable material

E: Release the femoral portion of medial collateral ligament while preserving tibial medial collateral ligament anchor

F: Semimembranosus release in the posteromedial corner of tibia with anterior translation of tibia on femur in flexion position

Table 1 Studies on medial soft tissue release techniques for varus deformity in total knee arthroplasty.

Technique	Authors	Year of publication	Study design	Numbers of cases	Studied group	Control group	Outcomes
Subperiosteal release of sMCL	Koo et al.	2009	retrospective cohort	15	complete MCL release	intact MCL	clinical and radiological outcome
	Prateeptongkum et al.	2014	prospective longitudinal	35	complete MCL release	none	clinical outcome, knee stability
	Cho et al.	2015	prospective cohort	209	complete MCL release	partial MCL release	clinical and radiological outcome, ROM
	Choi et al.	2018	retrospective cohort	549	over-release of MCL	intact MCL	clinical outcome, implant survival
Pie-crusting of MCL	Verdonk et al.	2009	prospective cohort	359	pie-crusting	subperiosteal release	clinical and radiological outcome
	Ha et al.	2015	retrospective cohort	729	pie-crusting	subperiosteal release	clinical outcome, knee stability
	Mehdikhani et al.	2015	retrospective cohort	416	pie-crusting	subperiosteal release	the use of constrained inserted, clinical outcome
	He et al.	2017	prospective cohort	78	pie-crusting	subperiosteal release	clinical and radiological outcome
Multiple needle punctures of MCL	Bellemans et al.	2010	prospective longitudinal	35	MNP in extension	none	clinical and radiological outcome, knee stability
	Koh et al.	2010	cross sectional study	35	MNP in extension	MNP in flexion	quantitative effects of MNP technique
Medial epicondylar osteotomy	Sim et al.	2013	retrospective cohort	20	medial epicondylar osteotomy	subperiosteal MCL release	clinical and radiological outcome
Femoral origin release of MCL	Lee et al.	2016	prospective longitudinal	17	femoral origin release of MCL	none	clinical and radiological outcome
Semimembranosus release	Koh et al.	2013	prospective cohort	104	post-release	pre-release	clinical and radiological outcome
	Kim et al.	2015	prospective cohort	267	post-release	pre-release	clinical and radiological outcome
	Jang et al	2016	prospective cohort	59	post-release	pre-release	flexion peak torque, clinical outcome, knee stability

sMCL: superficial medial collateral ligament
MCL: medial collateral ligament
MNP: multiple needle punctures

Conclusion

TKAs for knee OA with moderate to severe varus deformity always require the medial soft tissue release to reach the neutral mechanical axis. Many alternative methods have been proposed for medial soft tissue release. However, there is still no consensus on what the best method is. This literature review collected and compared some of the alternative methods with the conventional Insall technique. The newly proposed methods were pie-crusting technique, multiple needle puncture technique, medial epicondylar osteotomy, femoral origin release of the medial collateral ligament, and semimembranosus release. From a review, there were shown that each technique had its own unique superiority. Each of them should be considered to use in a distinct case of TKA. On the author's opinion, when generally consideration for TKAs, the conventional Insall technique is still the superior to others.

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วิธีและผลของการเลาะเนื้อเยื่อด้านในของข้อเข่าในการผ่าตัดเปลี่ยนข้อเข่าเทียมในผู้ป่วยที่มีการโก่งของขามาก

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การผ่าตัดเปลี่ยนข้อเข่าเทียมในผู้ป่วยข้อเข่าเสื่อมที่มีการโก่งของขามาก มักมีความจำเป็นต้องทำการเลาะเนื้อเยื่อด้านในของข้อเข่าเพื่อให้ขาตรงและได้ผลการผ่าตัดดีตามต้องการ อย่างไรก็ตาม ยังไม่มีข้อสรุปว่าวิธีการเลาะเนื้อเยื่อด้านในของข้อเข่าวิธีใดวิธีหนึ่งดีที่สุดในการแก้ไขปัญหาผู้ป่วยที่มีการโก่งของขามาก การทบทวนวรรณกรรมนี้เป็นการรวบรวมวิธีและความเห็นในแง่มุมต่างๆ ของการเลาะเนื้อเยื่อด้านในของข้อเข่าขณะทำการผ่าตัดเปลี่ยนข้อเข่าเทียม โดยเป็นการรวบรวมข้อมูลจาก Pubmed และ Google Scholar ซึ่งมีทั้งหมด 6 วิธี คือ subperiosteal release ของ superficial medial collateral ligament, pie-crusting technique, multiple needle puncture technique, medial epicondylar osteotomy, femoral origin release ของ medial collateral ligament และ semimembranosus release ทั้งนี้แต่ละวิธีมีข้อดีที่เฉพาะของวิธีนั้นๆ เองอย่างไรก็ตาม จากการวิเคราะห์ข้อดีและข้อด้อยของแต่ละวิธี คณะผู้นิพนธ์เห็นว่าวิธี subperiosteal release ของ superficial medial collateral ligament ตามแบบวิธีดั้งเดิม เป็นวิธีที่คณะผู้นิพนธ์เห็นว่าดีและนิยมใช้มากที่สุด