

What is the preferred option for reconstruction of a failed extensor mechanism during revision total knee arthroplasty?

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Response/recommendation:

There are multiple options for reconstruction of chronic extensor mechanism of the knee. The reconstructive options include the use of synthetic mesh, hamstring tendon with quadriceps tendon autograft and Achilles tendon allograft. Acute failure of extensor mechanism should be repaired directly with autograft augmentation, whenever possible.

Level of Evidence: Moderate

Rationale:

Extensor mechanism failure/disruption (EMF/EMD) is a rare but devastating complication in patients following total knee arthroplasty with a reported incidence between 0.17–2.5%(1). Extensor mechanism disruption can include failure at the level of quadriceps tendon, patella or the patellar tendon. Literature comprises of case reports and case series (comparative/non comparative) describing numerous methods of managing this condition. The literature search comprised of management of quadriceps tear, patellar tendon failure and patellar fractures in acute and chronic (>3 months) scenarios. However, literature describing the outcomes of repair with or without augmentation is scarce.

Majority of the literature describes management of chronic failure of extensor mechanism using allografts (whole extensor mechanism allograft [EMA]), Achilles tendon allograft (ATA), bone patellar tendon bone allograft (BPTB), autologous quadriceps tendon incorporating a patellar bone block with hamstring augmentation and synthetic grafts (Marlex mesh, polypropylene cables). Gastrocnemius flaps are described for complete soft tissue and extensor mechanism loss due to PJI.

We analysed 24 studies for chronic extensor mechanism failure and 5 studies for acute failures (less than 3 months). From these 24 studies, 484 patients with this condition were evaluated.

Of these, 192 patients were treated by EMA, 21 with QT-bone block and semitendinosus augmentation, 22 with ATA, 4 with PT-TT allograft, 6 with BPTB allograft, 21 with medial gastrocnemius flap and 218 with synthetic mesh/tapes.

For chronic extensor mechanism failure the EMA group had a mean failure rate of 32.89%, ATA group of 15.38%, BPTB allograft of 63% and synthetic grafts of 30.53%. However, failure rate of EMA and ATA have been found to be similar in a meta-analysis(2). A Literature review, recommended that EMA and ATA done with tensioning in full extension gives favourable results. Younger age and not tensioning of the allograft in extension was described as a predictor for failure(3).

Failures for Hamstring tendon/Quadriceps autograft are yet to be reported for chronic patellar tendon failures(4).

With regards to acute repair/reconstruction of QT, propylene mesh shows a 50% failure rate. Soft tissue augmentation with direct repairs had a 9% failure. Direct acute repairs, interestingly have shown better results with no failures.

Acute patellar tendon repair with hamstring (ST) graft or cable - UHMWPE cable reports showed no failure at an average follow up of 42 months. Similar findings were supported by a review article(5).

Periprosthetic joint infection, chronic disruptions, and patellar tendon tears are associated with poor out-comes in extensor mechanism repair/reconstruction (6)(7).

For acute patella fractures operative management was opted if displacement was more than 3 mm with EMD. Combined incidence of 11% was reported for non-union and extensor lag (>30 degrees) following operative intervention. Fractures with displacement of <3 mm were treated conservatively yielding better outcomes and no post recovery lag with/without union. No correlation of outcome and fracture patterns was observed.

Articles describing chronic EMF management

Author Names	Injury	Modality of Treatment
Weintraub (8)	EMF (Revision)	Allograft (EMR)
Chin Tat Lim (9)	QT, PT	Allograft – EMA, ATA
Lamberti (10)	PT	EMA, ATA, QSA
Ares(11)	PT	ATA
Baldini(12)	QT, PT	EMA
Wise(13)	ATA	ATA
Rajgopal (4)	PT	QSA
Ricciardi (14)	QT, PT, :PF	EMA
Perry(15)	EMF	Mesh
Brown (16)	QT, PT, PF	EMA
Malhotra (17)	PT	PT- TT allograft
Jaureguito(18)	EMF	Medial Gastrocnemius flap
Browne(19)	EMF	Mesh
Buller(20)	EMF	Mesh
Anderson (21)	QT, PT, PF	Allograft , Mesh
Richardson (22)	EMF	EMA,ATA, mesh
Leopold(23)	PT	BPTB Allograft
Abdel (24)	QT, PT, PF	Mesh
Ormaza(25)	QT	MUTARS
Russo(26)	EMF	Medial Gastrocnemius flap

EMF- Extensor Mechanism Failure

QT- Quadriceps Tendon
 PT- Patellar Tendon
 PF- Patella Fracture
 PT-TT- Patellar Tendon- Tibial Tuberosity
 EMA- Extensor mechanism allograft
 ATA- Achilles Tendon Allograft
 QSA- Quadriceps +Semitendinosus Allograft
 BPTB- Bone Patellar Tendon Bone Allograft

Articles describing Early EMF management

Author	Injury type	Modality of Management
Spoliti (27)	PT	HSA
Hasegawa(28)	PT	Polyethylene cable
Chhapan(29)	QT	Direct repair
Miralles-Munoz(30)	QT	Repair with V-Y turndown flap augmentation
Nodzo(31)	QT	Mesh Augmentation

HSA- Hamstring semitendinosus allograft

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