JSES International 8 (2024) 1137–1144

Contents lists available at ScienceDirect

JSES International

journal homepage: www.jsesinternational.org

Fascia lata allograft: a suitable alternative in ligamentous reconstruction for chronic elbow instability?

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ARTICLE INFO

Keywords:
Elbow instability
Fascia lata allograft
Triceps autograft
Bracing
Ligament reconstruction
Biomechanical suitability

Level of evidence: Level III; Retrospective Cohort Comparison; Treatment Study With Basic Science Study; Biomechanics

Background: Up to now, there is no gold standard concerning the optimal graft choice in the surgical therapy of chronic elbow instability. As donor site morbidity represents a rare (1%-4%) but severe complication of graft harvest, using an allograft seems favorable. Fascia lata mimics the anatomy through its fan-shaped configuration of the ligamentous complex of the elbow joint, making it questionable for use as a graft. The aims of the study are (1) to evaluate the biomechanical suitability of fascia lata allograft and (2) to compare clinical and radiological outcome between ligament reconstruction of the lateral collateral ligament complex using either FiberTape augmented triceps autograft or FibreTape augmented fascia lata allograft.

Methods: Biomechanical testing of fascia lata was performed using a 10 kN uniaxial test system with a 1 kN load cell. The retrospective cohort study evaluated all patients who received a ligament reconstruction of the elbow due to chronic instability with allogenic fascia lata or autologous triceps tendon. Exclusion criteria were any type of coexisting fracture or nerval injury. Demographic parameters, patient-reported outcome parameters and radiological stability parameters (sonography and fluoroscopy) were evaluated.

Results: Tensile testing of 39 fascia lata allografts revealed an ultimate load of 234.8 ± 23.1 N and ultimate strength of 33.4 ± 4.4 MPa. Twenty one patients were included in the clinical substudy (57.1% men, 42.9% women, age 41.0 ± 12.2 years, body mass index 24.9 ± 4.1 kg/m^2) with average follow-up of 21.6 ± 17.1 months. No significant differences were found concerning pain level, patient-reported outcome measures, or range of motion, between fascia lata and triceps group. There was also no difference concerning sonographic stability of lateral ulnar collateral ligament between the 2 groups ($P = .14$). One revision occurred in fascia lata allograft group and 2 in triceps autograft group due to graft elongation.

Conclusion: Currently, there is no clinical evidence demonstrating the superiority of either autograft or allograft tissue. Due to its demonstration of sufficient biomechanical properties, fascia lata allograft seems an appropriate treatment option for ligamentous reconstruction of chronic elbow instability.

The necessity of using an autograft or allograft for the surgical treatment of chronic elbow instability is undisputed since the quality of the native ligaments must be considered insufficient.[21] The technical procedure used for this is constantly evolving, questioning the type of fixation (anchor, trans-osseous, Endobutton; Smith & Nephew, Andover, MA, USA), the optimal isometricefixation point, and the choice of graft. With the introduction of an independent ligament brace technique, another stabilization procedure came to the fore, whereby the boundaries for the indication of the respective techniques (native refixation, ligament brace, and reconstruction) are to be regarded as fluid and are not clearly defined in the current literature.[2,3,21] The choice of grafts, either autograft or allograft, is still a matter for discussion. Whereas autografts such as palmaris longus, triceps, semitendinosus, gracilis, or Achilles tendon graft show good overall results,[2,3,21] a rare but severe complication is represented by donor site morbidity with an incidence between 1% and 4%.[6,17] Due

Ethical approval was confirmed by the local ethics committee (number: EA4/055/19) and every patient signed informed consent.

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https://doi.org/10.1016/j.jseint.2024.05.002

to this, alternative surgical techniques using synthetic material or allografts have once again become the focus of interest.[2,3,21] The choice of graft could also be dictated by the anatomical structure of the original ligaments. The ulnar and lateral collateral ligament configurations (medial collateral ligament [MCL] and lateral ulnar collateral ligament [LUCL]) are described as fan-shaped.[16] Therefore, cord-like allografts or autografts might not represent the optional graft for reconstruction of this anatomical configuration. In this sense, Camps et al described the need for splitting a thicker cord-like allografts/autografts to avoid a bulk.[7] Fascia lata is a coarse connective tissue sheath (fascia) on the thigh that macroscopically mimics the thin-layered anatomy of the ligamentous complex very well (Fig. 1). Some authors used additional to reinforce the autograft or allograft allowing early functional rehabilitation.[18,35]

The aim of this study is to evaluate the feasibility of the fascia lata allograft for ligament reconstruction in chronic elbow instability. Therefore, first experimental trial of the study tested biomechanical data of fascia lata in collaboration with the German Institute for Cell and Tissue Replacement (DIZG) to evaluate their suitability as allograft in chronic elbow instability. Second, the clinical trial compared subjective, functional, and radiographic outcome between augmented fascia lata allograft and augmented triceps autograft as established graft in LUCL reconstruction.

Methods

Biomechanical testing of fascia lata allografts

The human allograft tissues used in this study were provided by the institutional tissue bank. All human tissues were acquired from nonprofit tissue recovery partners after informed consent. Grafts were sterilized using a validated, good manufacturing practice-compliant process and were approved as medicinal products under §21 and §21a of the German Medicinal Products Act. Fascia lata was freed from adherent tissue before sterilization. For sterilization, tissues were fully submerged in a validated tissue-preserving sterilization solution (2% peracetic acid, 96% ethanol, water for injection; ratio v/v/v 2/1/1) and incubated with constant agitation at low pressure and room temperature for 4 hours.[26] Subsequently, tissues were rinsed in a washing process using water for injection. After a freeze-drying process, fascia lata allografts were aseptically packed and stored at room temperature. To avoid any bias, the biomechanical analysis was performed by German Institute for Cell and Tissue Replacement (DIZG nonprofit GmbH, Berlin, Germany).

Biomechanical testing was performed using a 10 kN uniaxial test system (Hegewald and Peschke, Nossen, Germany) with a 1 kN load cell. Thirty-nine rectangular specimens (20 × 10 mm) from 4 donors were tested in 2 groups. The test groups were based on the fiber orientation with tensional force applied parallel (n = 18) and orthogonal (n = 21) to the fiber orientation. Fascia lata allografts were rehydrated in 0.9% saline solution for at least 30 minutes followed by a measurement of dimensions using a caliper. The probes were fixed to the test system with pneumatic clamps at a pressure of 1.5 to 5 bars. Direct tensional load to failure analysis was conducted at 50 mm/min speed. Ultimate load (UL) to failure, strength, strain, and Young's Modulus (YM) were calculated.

Retrospective clinical study

The retrospective cohort study was approved by local ethics committee (EA4/055/19). Institutional database was evaluated for all patients who received a ligament repair between January 1, 2010 and January 1, 2020 due to chronic elbow instability. Those were identified by searching for all patients demonstrating the combination of International Classification of Diseases 10 M25.32 and

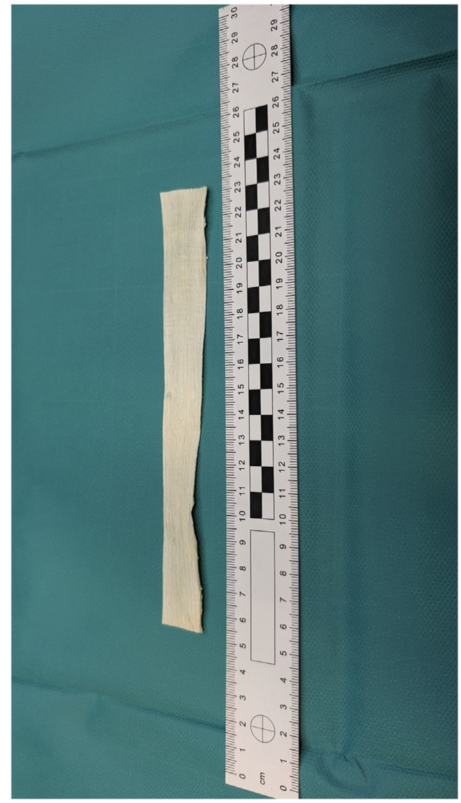

Figure 1 Fascia lata allograft.

Operationen- und Prozedurenschlüssel Code 5-807.0. One hundred and seventeen cases were identified and re-evaluated concerning inclusion and exclusion criteria. Patients with a reconstruction of LUCL complex in case of elbow instability (at least grade 2) using fascia lata allograft or triceps tendon autograft with additional FiberTape (Arthrex, Naples, FL, USA) bracing were only included. Exclusion criteria were any type of coexisting fracture or nerval injury as well as adapted surgical techniques not following the technique described in the following (eg, palmaris longus autograft, isolated bracing). All suitable patients were contacted and informed about study design and offered participation. Twenty six patients participated in the study. As 5 of them showed no additional bracing of allograft, those were excluded also and will be worked up in another study. Patients' enrolment is demonstrated in Figure 2.

Demographic information

For all participants, baseline characteristics including age, sex, dominant side, operated side, and trauma history (chronic vs. acute instability) were assessed. To evaluate general hypermobility, the Beighton score was applied.[5] Furthermore, surgical technique (fascia lata allograft vs. triceps autograft with additional FiberTape bracing) was noted. Based on the surgical technique, the study population was divided into 2 patient groups: (1) braced fascia lata allograft group and (2) braced triceps autograft group for LUCL reconstruction, respectively.

Patient-reported outcome measures

For patient-reported outcome measures (PROMs) Mayo elbow performance score (MEPS)[10] as well as Disabilities of Arm, Shoulder, and Hand Questionnaire (DASH) score were performed.[25]

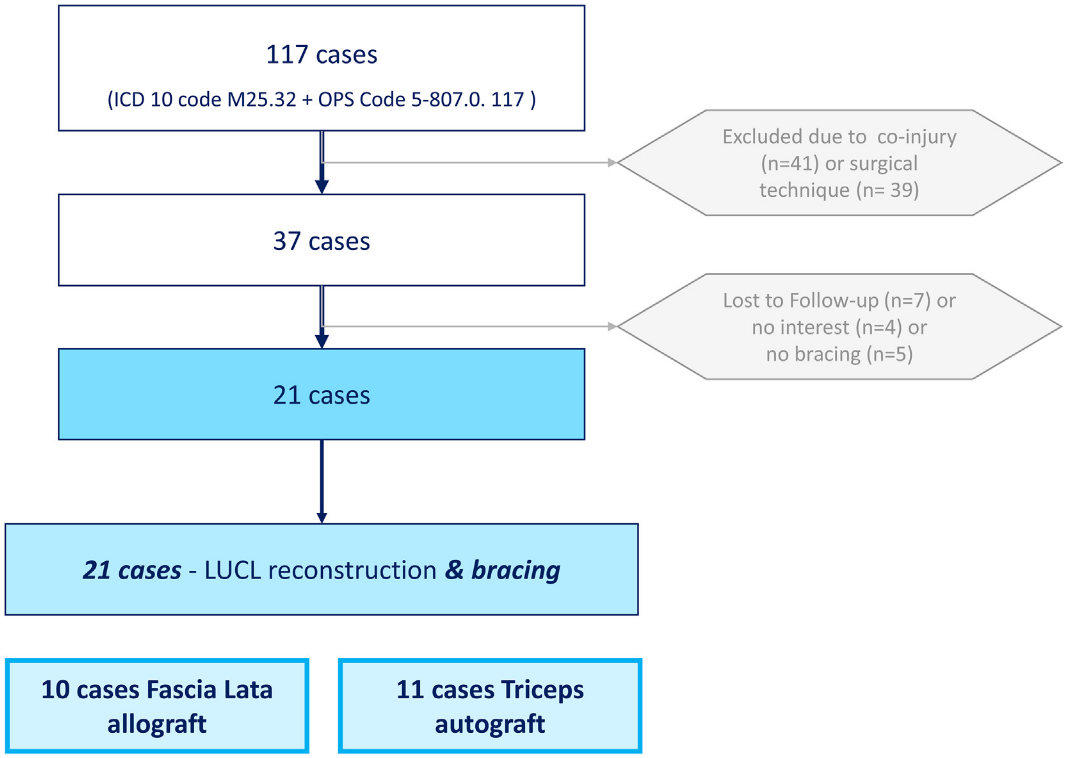

Figure 2 Patients' enrolment. *LUCL*, lateral ulnar collateral ligament; *ICD*, international classification of diseases; *OPS*, Operationen- und Prozedurenschlüssel.

Additionally, subjective elbow value (SEV) and general satisfaction with the surgical result were evaluated using the German school grading system (1: best, 6: worst).[31]

Clinical outcome parameters

Clinical examination included determining active range of motion (ROM) of both elbow joints and performed clinical medial (valgus stress test, Milk maneuver, and Moving valgus test) and lateral stability tests (Posterolateral Rotatory Drawer Test and Tabletop relocation test).[8,30] Complications while follow-up were documented.

Radiological outcome parameters

Postoperative examination for varus, valgus, and posterolateral instability was performed by fluoroscopy. However, due to technical measurement inaccuracies only a positive drop sign and radiocapitellar incongruity while forced hypersupination (lateral view)[23,24] were assessed. All participants underwent a standardized sonographic examination of both elbow joints using a multifrequency (15-6 MHz) linear array transducer (SonoSite; Fujifilm Sonosite, Bothell, WA, USA) to evaluate the joint gap on the ulnohumeral and radiocapitellar compartments as delta between neutral and stressed positions following the method described in our previous study.[19] Distance increments following stress maneuvers were presented as delta values [mm] for both the radial and ulnar sides. Major joint gaping was evaluated as delta >2 mm.[19] Fluoroscopy as well as sonography were performed in all cases by the same, experienced orthopedic consultant to exclude examiner-associated bias.

Surgical technique

Depending on possible concomitant diseases, a diagnostic elbow joint arthroscopy was performed before open procedure. In case of posterolateral instability, we started with a lateral skin incision and subsequent layer-by-layer preparation with approach to the joint via Kocher interval. Subsequently insufficient ligament structures were visualized followed by an exploration of the humeral (below the radial epicondyle) and ulnar (crista supinatoria ulnae) insertion point. After that, we prepared drill holes according to the graft thickness taking the isometrics into account (ulna: 2.7 mm hole for an 3.2 Endobutton; distal humerus: docking technique with a central 5-6 mm drill hole). For the preparation of the autograft (triceps tendon), a 6-7 cm long tendon strip is taken from the thickened ulnar part of the central triceps tendon and braced with FiberWire. Analogous procedure was performed when choosing the facia lata allograft. Before the tendon is pulled in through the drill holes, closure of the capsule was required so that the graft is not in direct contact with the joint edge and placed extra-articular. Finally, the graft (and brace, Fig. 3) was fixed with an Endobutton ulnar and tenodesis screw humeral sided in 60° flexion.

Postoperatively, short-term immobilization in the upper arm cast was performed for adequate soft tissue consolidation. There were no restrictions on mobilization of the wrist and shoulder joint. In the further course, the patient was switched to an articulating orthosis with limitation of the final degree of flexion and extension (0/30/90) to protect the collateral ligament reconstruction. From the fourth week, the ROM is increased (0/10/120) until the end of the sixth postoperative week with final free ROM. A stabilization program is initiated from the seventh week. We do not recommend contact sports until 6 months after the operation.

Statistical analysis

Biomechanical data are presented as mean ± standard deviation. For statistical comparison, normal distribution of the data was confirmed by the Shapiro-Wilk test and unpaired, 2-tailed Welch's

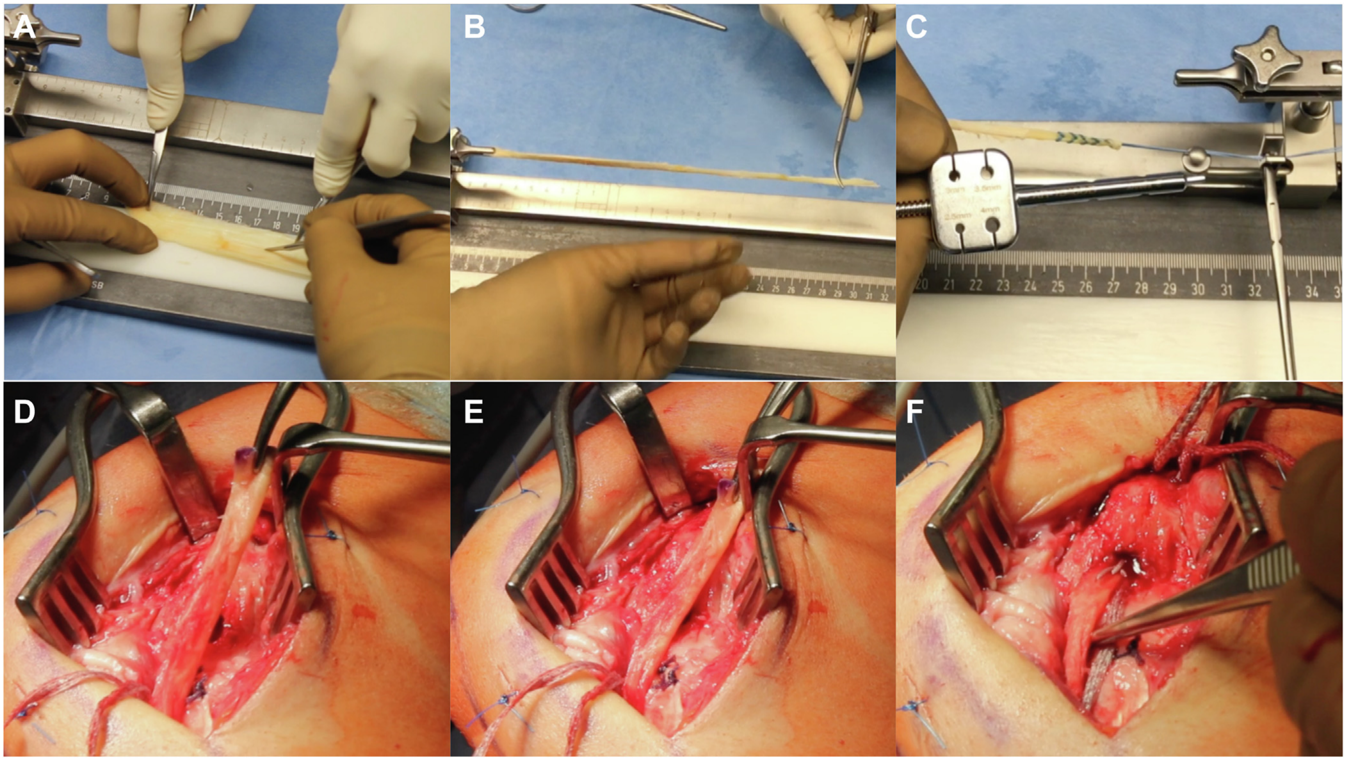

Figure 3 Surgical procedure: (**A** and **B**) Preparation of the allograft with resection of a 5-7 mm wide, 10 cm long strip from the existing allograft of the tissue bank. (**C**) One-sided reinforcement of the prepared graft. The necessary length of the graft is determined in situ. (**D**) Refixation of the reinforced graft end, if necessary together with a brace, ulnar sided using an Endobutton. (**E**) In situ length determination of the graft, reinforcement and determination of the humeral isometric refixation point. (**F**) Refixation on the humeral side of the graft, if necessary in combination with a brace, in the isometric point by using a tenodesis.

t-tests were performed. Descriptive statistics concerning clinical data including mean, standard deviation, minimum, and maximum values of continuous variables were calculated. Differences concerning demographic data (age, follow-up, body mass index, and Beighton score), patient outcome parameters (MEPS, DASH, pain level [Numeric Rating Scale {NRS}], satisfaction, and SEV), and clinical outcome parameters (ROM, sonography, and fluoroscopy) between the 2 groups were assessed using Mann-Whitney U test for non-normally and unpaired *t*-tests for normally distributed data. Distribution was tested using the Shapiro-Wilk test. For comparison of operated and nonoperated elbow concerning the clinical outcome (ROM, sonography, and flouroscopy), the Wilcoxon signed rank test was used for non-normally and paired *t*-test for normally distributed data. Chi-squared test was used comparing nominal parameters between the 2 braced groups (sex and operated side). $P < .05$ was considered significant.

Results

Prestudy biomechanical results

Tensile testing of 39 fascia lata allografts revealed significantly higher values for YM (337.5 ± 37.3 MPa), UL (234.8 ± 23.1 N), and ultimate strength (33.4 ± 4.4 MPa) for specimens tested in line with the allograft's fiber orientation compared to orthogonal (YM: 21.0 ± 9.8 MPa, UL: 23.1 ± 7.9 N, and ultimate strength: 3.6 ± 1.5 MPa) testing (each $P < .01$, Fig. 4). The ultimate strain was significantly increased when the allografts were stretched perpendicular to the direction of the fibers (parallel: 14.1 ± 1.8 vs. orthogonal: 28.8 ± 5.6%, $P < .01$). In general, the anisotropic nature of fascia lata allografts could be demonstrated.

Retrospective clinical study results

Twenty one patients were included in the recent study (57.1% men and 42.9% women). Average age was 41.0 ± 12.2 (15-57) years, average body mass index was 24.9 ± 4.1 (20.2-35.0) kg/m^2, and average follow-up was 21.6 ± 17.1 (6-50) months. In 61.9% of all cases, the right elbow was treated, in 38.1% the left one. In 61.9% of all cases, the operated elbow was the dominant one. Average Beighton score was 2.3 ± 2.4 (0-8).

There were 10 cases of LUCL reconstruction with fascia lata allograft, and 11 cases of reconstruction with triceps autograft. No significance differences were found in demographics between the fascia lata allograft and triceps autograft group (Table 1).

Patient outcome parameters

No significant differences were found concerning PROMs between braced fascia lata allograft and triceps autograft group postoperatively after an averaged follow-up of 23.8 ± 17 (6-53) months. Results of MEPS, DASH, SEV, and NRS are demonstrated in Figure 5, *A*. Satisfaction (grade) also showed no significant differences (Fig. 5, *B*, $P > .29$).

Clinical outcome parameters

No significant differences were found concerning ROM between braced fascia lata allograft and triceps autograft group (each $P > .28$) or between the operated and contralateral elbow within each group (each $P > .08$).

Radiological outcome parameters

None of the patients showed positive drop at hypersupination in lateral fluoroscopy.

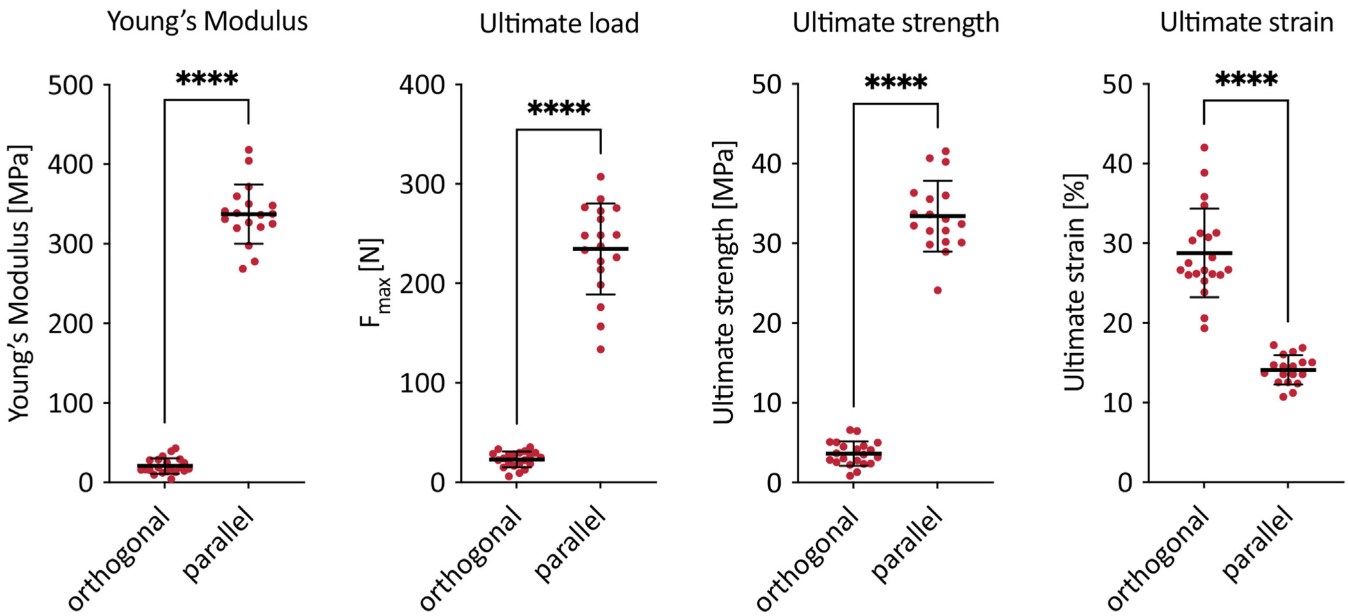

Figure 4 Presentation of biomechanical data. Fascia lata samples have been clamped and tension was applied until complete rupture of the grafts. Significant differences are denoted by asterisks (****: $P < .01$).

Table 1
Patient demography.

	Fascia lata (n = 10)	Triceps (n = 11)	*P* value
Age [y]	44.0 ± 8.3 [32-56]	38.7 ± 14.6 [15-57]	>.05
BMI [kg/m^2]	24.4 ± 3.5 [20.3-31.2]	25.9 ± 4.2 [20.2-35.0]	>.05
Follow-up [mo]	18.1 ± 13.2 [6-47]	25.0 ± 20.5 [6-50]	>.05
Beighton score [pts]	1.5 ± 2.1 [0-6]	3.0 ± 2.4 [0-8]	>.05
Sex [m:f, %]	50:50	64:36	>.05
Operated side [right:left, %]	70:30	55:45	>.05

BMI, Body Mass Index.

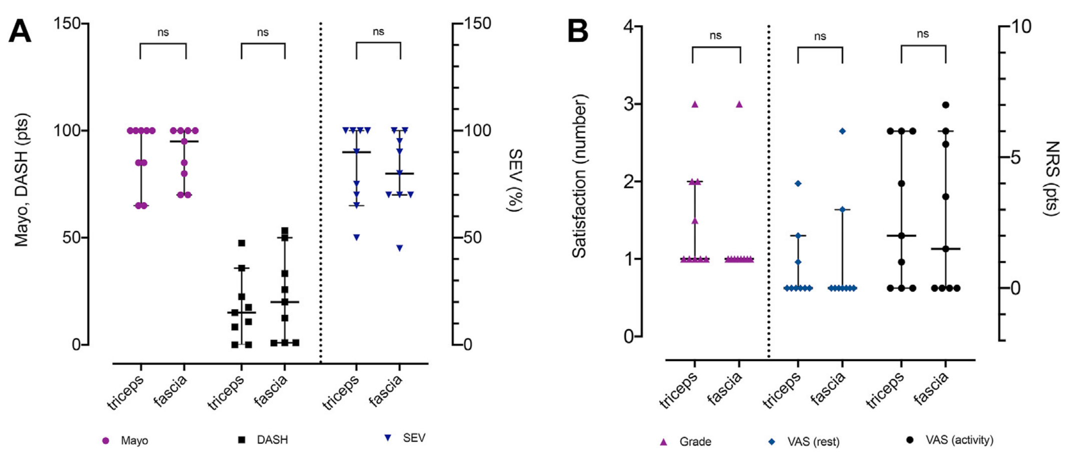

Figure 5 (**A**) Comparison of MEPS (triceps: 88.9 ± 15.0 [65-100] vs. fascia lata: 88.9 ± 12.9 [70-100] [$P > .05$]), DASH (triceps: 17.5 ± 15.8 [0-48] vs. fascia lata: 23.0 ± 20.5 [1-53] [$P > .05$]), and SEV (triceps: 83.3 ± 18.9 [50-100] vs. fascia lata: 80.0 ± 18.2 [45-100] [$P > .05$]). (**B**) Comparison of satisfaction (triceps: 1.3 ± 0.7 [1-3] vs. fascia lata: 1.2 ± 0.7 [1-3] [$P > .05$]) and pain level (NRS) at rest (triceps: 0.8 ± 1.4 [0-4] vs fascia lata: 1.0 ± 2.1 [0-6] [$P > .05$]) and at sports (triceps: 2.8 ± 2.7 [0-6] vs. fascia lata: 2.6 ± 2.9 [0-7] [$P > .05$]) showed no significant differences between the 2 groups. *SEV*, Subjective Elbow Value; *MEPS*, Mayo Elbow Performance Score; *NRS*, Numeric Rating Scale; *DASH*, Disabilities of Arm, Shoulder, and Hand Questionnaire.

Regarding sonographical examination, there were no significant differences concerning posteroradial stability after LUCL reconstruction between braced fascia lata allograft and braced triceps autograft group (delta fascia lata allograft: 0.51 ± 0.54 [0.10-1.7] vs. triceps: 0.87 ± 0.69 [0.10-2.5], $P = .14$) neither compared to contralateral healthy elbow (radial delta fascia lata healthy elbow: 0.80 ± 0.81 [0.1-2.7] vs. triceps: 0.87 ± 0.55 [0.10-1.60], $P = .55$) (Fig. 6, *A*). For better visualization, we also chose the percentage

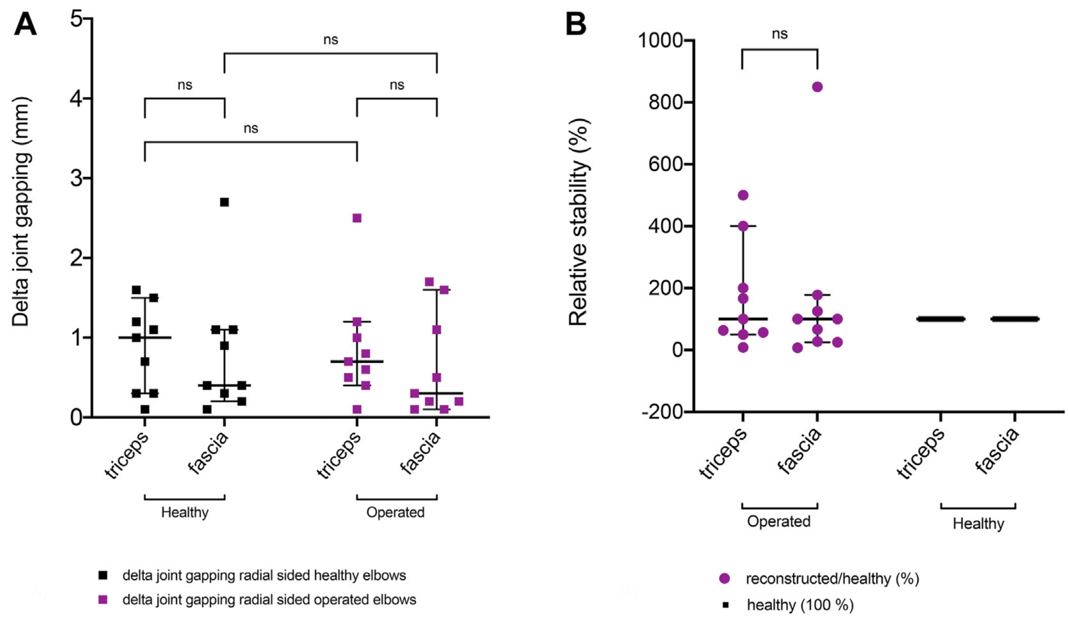

Figure 6 (**A**) Comparison of sonographic joint gapping [mm] of operated radial side between fascia lata and triceps group for the operated and nonaffected side. (**B**) Visualization of the percentage increase ("relative stability") in the joint gapping compared to the corresponding joint space on the healthy opposite side.

increase in the joint space compared to the corresponding joint space on the healthy opposite side ("relative stability": fascia lata allograft group: 150% ± 266 vs. triceps autograft group: 173 ± 170, $P > .34$) (Fig. 6, *B*).

Complications

One revision occurred in fascia lata allograft group and 2 revisions in triceps autograft group. All revisions were performed due to recurrent instability (graft elongation). In 2 cases (1 fascia lata allograft and 1 triceps autograft case), no new trauma was found as reason for recurrent instability. One patient in triceps autograft group complained about persisting pain in area of triceps tendon harvest which was interpreted as donor-side morbidity.

Discussion

The need for surgical treatment of chronic elbow instability is undisputed, although in this case refixation of the native ligaments is not the treatment of choice.[21] Up to now, there is no gold standard concerning the technique and graft choice for reconstruction of chronic ligamentous insufficiency. As harvest of autografts can cause donor-side morbidity,[6,17] allografts seem an attractive alternative. The following publication discusses the possibility of using allogenic fascia lata, assuming that this graft imitates the ligament structurally well, but also has the necessary biomechanical properties. For this purpose, we have developed a study concept, which first examined and confirmed the biomechanical characteristics of fascia lata as a suitable allograft. Second, for a clinical application observation, a retrospective clinical evaluation was carried out afterwards with a comparison of 2 (3) patient groups with different grafts and additive bracing as well as singular use without the supportive effect of bracing. The biomechanical investigations of the fascia lata showed a similar load capacity as described for native elbow ligaments.[27] Significantly higher values for YM, UL, and strength could be demonstrated in parallel orientation (ie, in the longitudinal direction). These are the desired properties and also correspond to the preferred loading direction for longitudinal implantation in surgery. Only the elongation is orthogonally greater, which is rather due to the fact that the fibers are pulled apart slowly (even at lower loads) and do not tear abruptly at high forces.

The most common autograft for ligament reconstruction of the elbow is palmaris longus tendon as it offers easy preparation without significant loss of function or high incidence of donor-side morbidity.[17,22] Unfortunately, the palmaris longus is missing in up to 25% of the population.[1,28] Therefore, other techniques using gracilis, semitendinosus, or triceps tendon grafts demonstrated incidences of donor site morbidity between 1% and 4% depending on the chosen tendon.[6,17] Using the hamstring tendons seems unattractive as another extremity will be impaired by graft harvest through pain and scar tissue and reduced function of the hamstring group.[9,33] Accordingly, triceps tendon autograft offers a most reasonable alternative due to its easy availability with slightly extended access or via a small additional incision.[9] Kodde et al reported excellent results using triceps autograft for reconstructing MCL in athletes with an average postoperative MEPS of 91 (80-100) points.[20] Similar successful results could be reached for LUCL reconstruction using triceps tendon autograft[11,15,32] analyzed by Geyer et al. They reported equal results concerning NRS, SEV, DASH score, and revision rate (11.5% vs. 12.9%) compared with the present study using triceps autograft for LUCL reconstruction.[15] Schoch et al showed continuous consistency for stability even after an average of 7.5 years using an autologous ipsilateral triceps tendon as graft for LUCL reconstruction.[32]

However, despite demonstrably low donor-side morbidity, a theoretical weakening of the triceps tendon structure is conceivable with a harvest in the central tendon portion. A biomechanical study of Baumfeld et al demonstrated that the central third of the triceps tendon can handle the highest load (704 N) compared to the medial (488 N) or lateral (317 N) part.[4] As the highest failure loads of the strongest elbow ligament (anterior bundle of the MCL) is reported at 261 N,[27] it seems that use of every portion of triceps tendon might be sufficient for the ligamentous reconstruction of the elbow. However, taking one of these parts as autograft means to weaken the original tendons ultimate failure load. Therefore, the use of an allograft seems favorable as it offers several advantages: no need of an additional or extend of the incision, shorter operating time, and no risk of donor-side morbidity or impaired function of the harvested region.

Erickson et al compared outcome after MCL reconstruction depending on graft choice (palmaris longus autograft, hamstring autograft or allograft) without identifying any significant differences.[14] As limitation, it must be pointed out that only 11 patients were included in allograft group without any specification of the used allograft itself. Savoie et al described comparable outcome of MCL reconstruction using either hamstring allograft or hamstring autograft after 24 months.[29] To our knowledge, there is no literature comparing allograft and autograft reconstruction of LUCL by now.

Our study demonstrated equivalent results concerning PROMs, pain, and ROM between fascia lata (allogenic) and triceps tendon (autologous) group for LUCL reconstruction. No significant differences related to radiographic stability examination (partial fluoroscopy and sonography) between those groups were observed. Those results demonstrate that reconstruction of LUCL using fascia lata allograft is possible and not inferior to the established use of autologous triceps tendon.

However, the influence of the graft bracing has to be discussed. The initial intention of the bracing was to reinforce the graft and thereby allowing early functional rehabilitation while the ligament reconstruction beneath is healing.[12,35] Ellwein et al reported that LUCL repair without internal bracing failed at 12.1 Nm; in contrast, the maximum load to failure for the internal bracing groups was between 23.2 and 26.6 Nm ($P < .05$) depending on humeral fixation technique of the LUCL.[12] This significant increase in primary stability allows early functional treatment and therefore seemed an excellent addition to traditional graft reconstruction of LUCL. However, Geyer et al reported excellent results using the triceps tendon autograft without an additional bracing.[15] As the patients were allowed to perform free active motion if supported by a hinged brace, there seems to be no disadvantage in using unbraced triceps tendon autografts concerning rehabilitation. A potential advantage of unbraced ligament repair seems the reduced risk of heterotopic ossification (11%-29%), overtensioning of the tape resulting in elbow stiffness, suture granuloma, or damage to the cartilage of the capitulum since the tape runs along.[13]

Unfortunately, the existing costs have a disadvantageous effect on the presented technique. At authors' institution, fascia lata allograft is provided by the institutional setting and costs 230-625 €, depending on allograft size (20 × 70 mm to 40 × 100 mm). Therefore, the triceps allograft seems more reasonable from an economic point of view as it reduces costs. On the other hand, harvesting of triceps tendon as well as closing the extended wound increases operation time. As an average operation minute costs 62$/min (range 22-133$), the shorter surgical time at least partially compensates for the higher acquisition costs.[34] However, as patient's outcome and not economic aspects should lead a surgeon's decision, this "limitation" should of course be discussed but not highlighted. Altogether, fascia lata represents a safe alternative without risk of donor-side morbidity or weakening young patient's triceps tendon.

The study has several limitations. Due to the small number of cases, the observations can only be generalized to a limited extent. On the other hand, the low number of cases is a result of the strict patient selection in injury pattern and uniformity of surgical procedure to exclude a possible bias due to concomitant injuries that actually represents a strength of the study. Of course, the potential risk of using an allograft such as infection has to be mentioned, although the risk for the patient is kept to a minimum due to strict production regulations (sterility testing is performed in accordance with the European Pharmacopoeia [Ph. Eur. 2.6.1]).

Conclusion

Fascia lata allograft demonstrated structural similarity to LUCL as well as sufficient biomechanical properties concerning maximum load making it a suitable allograft option for reconstruction of chronic LUCL instability. Also, clinical outcome is promising and is comparable to a reconstruction with triceps tendon autograft, whereas fascia lata offers some theoretical advantages as shorter surgical time, decreased risk of donor-side morbidity, and impaired function of triceps tendon through harvesting compared to autografts.

Disclaimers:

Funding: No funding was disclosed by the authors.
Conflicts of interest: No funding or commercial associations that might pose a conflict of interest in connection with the submitted article related to the author or any immediate family members.

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