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Return to work following distal triceps repair

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Purpose: The purpose of this study was to evaluate the rate and duration of return to work in patients undergoing distal triceps repair (DTR).

Methods: Consecutive patients undergoing DTR from 2009 to 2017 at our institution were retrospectively reviewed at a minimum of 1 year postoperatively. Patients completed a standardized and validated work questionnaire; a visual analog scale for pain; the Mayo Elbow Performance Score; the short version of the Disabilities of the Arm, Shoulder and Hand questionnaire; and a satisfaction survey.

Results: Of 113 eligible patients who underwent DTR, 81 (71.7%) were contacted. Of these patients, 74 (91.4%) were employed within 3 years prior to surgery (mean age, 46.0 ± 10.7 years; mean follow-up, 5.9 ± 3.9 years). Sixty-nine patients (93.2%) returned to work by 2.2 ± 3.2 months postoperatively. Sixty-six patients (89.2%) were able to return to the same level of occupational intensity. Patients who held sedentary-, light-, medium-, and high-intensity occupations were able to return to work at a rate of 100.0%, 100.0%, 80.0%, and 76.9%, respectively, by 0.3 ± 0.5 months, 1.8 ± 1.5 months, 2.5 ± 3.6 months, and 4.8 ± 3.9 months, respectively, postoperatively. Of the workers' compensation patients, 15 (75%) returned to work by 6.5 ± 4.3 months postoperatively, whereas 100% of non–workers' compensation patients returned to work by 1.1 ± 1.6 months ($P < .001$). Seventy-one patients (95.9%) were at least somewhat satisfied, with 50 patients (67.6%) reporting excellent satisfaction. Seventy-two patients (97.3%) would undergo the operation again if presented the opportunity. A single patient (1.4%) required revision DTR.

Conclusions: Approximately 93% of patients who underwent DTR returned to work by 2.2 ± 3.2 months postoperatively. Patients with higher-intensity occupations had an equivalent rate of return to work but took longer to return to their preoperative level of occupational intensity. Information regarding return to work is imperative in preoperative patient consultation to manage expectations.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Return to work; distal triceps repair; outcomes; elbow; triceps tear; triceps rupture

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Acute distal triceps ruptures are relatively rare injuries, occurring in <1% of the adult population.[5,15,21,28] Partial-thickness tendon tears in the absence of motor weakness are generally treated nonoperatively; however, high-grade tears that comprise >50% of the tendon most commonly show

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notable weakness in elbow extension and are treated with operative intervention.[24] These tears commonly include rupture of the superficial tendinous portion of the triceps with the deep muscular extension of the medial head remaining intact. Various operative techniques have been described, including primary repair, transosseous bone tunnel repair with suture, suture anchor repair, or hybrid fixation with bone tunnels and suture anchors.[7,29,30] Distal triceps repair is commonly performed in younger patients, who comprise the majority of the workforce.[26] Return to work (RTW) is an important metric as employment has been associated with increased self-esteem, a sense of purpose, and better mental health.[23,25]

Distal triceps repair results in favorable outcomes regarding range of motion, strength, failure, patient-reported outcome measures, return to active duty among military service members, and return to sport among National Football League players.[5,6,8,13,15,17,20,21,27,28] Despite favorable outcomes, RTW represents a significant outcome in young, active patients, who comprise the majority of the workforce.[26] Detailed RTW outcomes have not been described in patients undergoing distal triceps repair.

The purpose of this investigation was to assess the rate and timeline of RTW following distal triceps repair. We hypothesized that patients in higher-intensity occupations would demonstrate a lower rate of return to their previous level of work intensity and a longer duration of absence from work in comparison to patients in lower-intensity occupations.

Methods

This was a retrospective analysis of consecutive patients who underwent distal triceps repair from 2009 to 2017 at our institution. Indications for operative management included acute complete triceps tears as well as partial tears (>50%) associated with significant weakness. The inclusion criteria for this study were patients who received distal triceps repair, were aged ≥ 18 years at the time of surgery, and were available for minimum 1-year follow-up. Patients were excluded if they had complex concomitant injuries, previous distal triceps repair, or advanced ulnohumeral arthritis. Patients who underwent previous elbow surgery were included in the analysis.

Patients were contacted to complete a survey regarding satisfaction and work outcomes. As part of the survey, patients also completed the Mayo Elbow Performance Score (MEPS); the short version of the Disabilities of the Arm, Shoulder and Hand Score questionnaire (QuickDASH); and a visual analog scale (VAS) for pain. The work questionnaire has been administered previously to describe outcomes following orthopedic procedures.[1-3,9-12,16,18,19] Occupational intensity was divided into high, medium, low, or sedentary occupations based on the US Department of Labor classification (Table I).[1-3,9-12,16,18,19] Patient records were reviewed to identify preoperative diagnosis, injury characteristics, demographic information, complications, and surgical history and to obtain preoperative radiographs.

Surgical techniques

All techniques were performed through a posterior approach to the elbow. Any enthesophytes and calcifications were removed, and diseased portions of the distal triceps were excised. With the deep muscular insertion of the triceps often intact, a plane was developed between the ruptured and nonruptured portions where applicable to facilitate advancement of the ruptured tissue to the repair site. Primary repair was used for transtendinous injuries, whereas bony repair was performed in cases of tendinous avulsions.

Primary repair

The proximal and distal ends of the triceps tendon were débrided to expose fresh tendinous tissue and primarily repaired with a No.

Table I Categorization of work by demand

Demand level	Description
Sedentary	Work involves exerting up to 4.5 kg (10 lb) of force occasionally or a negligible amount of force frequently to lift, carry, push, pull, or otherwise move objects. Sedentary work involves sitting most of the time but may involve walking or standing for brief periods. Jobs are considered sedentary if walking and standing are required occasionally and all other sedentary criteria are met.
Light	Work involves exerting up to 9.1 kg (20 lb) of force occasionally, up to 4.5 kg (10 lb) of force frequently, or a negligible amount of force constantly. If the amount of lifted weight is a negligible amount, a job may be rated as light work if it (1) requires walking or standing to a significant degree; (2) involves sitting a significant amount of time but requires constant pushing or pulling of controls; or (3) requires working at a production pace, where an individual constantly pushes or pulls negligible weight.
Moderate	Work involves exerting 9.1-22.7 kg (20-50 lb) of force occasionally, 4.5-11.3 kg (10-25 lb) of force frequently, or a negligible amount to 4.5 kg (10 lb) of force constantly.
Heavy	Work involves exerting 22.7-45.4 kg (50-100 lb) of force occasionally, 11.3-22.7 kg (25-50 lb) of force frequently, or 4.5-9.1 kg (10-20 lb) of force constantly to move objects.

All physical demand requirements are in excess of the previous level. "Occasionally" indicates an activity or condition that exists for up to one-third of the time; "frequently," from one-third to two-thirds of the time; and "constantly," from two-thirds to most of the time.

2 nonabsorbable suture in a horizontal mattress or figure-of-8 configuration.

Repair to bone

The bony insertion was débrided down to healthy bleeding trabecular bone. For transosseous tunnels, a running, locking heavy nonabsorbable whipstitch suture was passed several times on alternating ends of the tendon. Two transosseous drill holes were created near the medial and lateral edges of the insertional footprint and driven through the olecranon in a crossed configuration parallel to the joint surface. Each strand of the suture was passed through the proximal end of each drill hole, and the strands were tied to one another over the olecranon bone bridge.[27,30] Alternatively, a suture anchor repair was performed, including similar bone preparation followed by the placement of 2 anchors at similar points as the entry points for the transosseous tunnels. The anchor size was approximately 3.0 mm, and No. 2 or 5 suture was most commonly used.

Rehabilitation protocol

Following distal triceps repair, patients were placed in a hinged brace and were instructed to limit elbow flexion to 20° for the first 2 weeks postoperatively. Between 2 and 6 weeks, they gradually increased the flexion tolerance up to 90° of active flexion, with no passive flexion or active extension. At 6 weeks, patients began advancing active and passive range of motion in both flexion and extension without restriction. At 8 weeks, patients were allowed to perform triceps isometrics until they fully progressed to full strength. Patients were allowed to return to sports or recreational activity and heavy labor once adequate range of motion and muscle strength returned, most commonly at 3-4 months postoperatively.

Statistical analysis

RStudio software (version 1.0.143; R Foundation for Statistical Computing, Vienna, Austria) was used to perform statistical analysis. Descriptive analysis of continuous variables included means and standard deviations, whereas frequencies and percentages were used to report discrete variables. The rate and duration of RTW were compared across occupational intensities using χ^2 testing and analysis of variance. A binomial logistic regression was performed to assess the effect of demographic and surgical variables on the likelihood of RTW at the preoperative level of occupational activity, whereas a multivariate linear regression was used to assess predictive factors for the duration of RTW. Statistical comparisons were considered significant at $P \leq .05$.

Results

Patient demographic characteristics

A total of 113 patients underwent distal triceps repair without other major concomitant procedures from 2009-2017. Thirty-two patients were lost to follow-up, leaving 81 patients (71.7%) eligible for inclusion in this investigation. Of the eligible patients, 74 (91.4%) were employed within 3 years of surgery and were included in the final analysis. The demographic characteristics of the included patients are provided in Table II. Distal triceps repair was the primary surgical procedure (first operation on the native elbow) in 65 patients (87.8%), which also included open reduction–internal fixation of an olecranon, medial epicondyle, or distal humeral fracture (n = 7, 9.7%); distal biceps tendon repair (n = 1, 1.4%); or ulnar nerve transposition (n = 1, 1.4%). Previous surgery was performed on the contralateral elbow in 12 patients (16.2%), including 6 distal triceps repairs (8.1%). The mechanism of injury was identified as direct trauma (n = 51, 68.9%), extension or lifting (n = 21, 28.4%), and hyperextension or hyperflexion (n = 2, 2.7%). Injuries occurred as the result of an accident (n = 22, 29.7%), work-related incident (n = 14, 18.9%), sporting activity (n = 32, 43.2%), or chronic degeneration (n = 5, 6.8%). No patients required allograft supplementation of the repair. Operative details are provided in Table III.

Return to work

Of the patients, 69 (93.2%) returned to work at an average of 2.2 ± 3.2 months following distal triceps repair. Sixty-six patients (89.2%) were able to return to the same level of occupational intensity according to the US Department of Labor classification system. Of the 5 patients who were unable to RTW in any capacity following distal triceps repair, 3 (60.0%) received disability payments. At the time of surgery, 20 patients (27.0%) were covered by workers' compensation, of whom, 15 (75%) were able to return to their previous occupation by 6.5 ± 4.3 months postoperatively. Comparatively, 100% of patients with non–workers' compensation designation returned to work by 1.1 ± 1.6 months ($P < .001$). Of the patients who underwent previous surgery on their elbow, 78% returned to work by 0.95 ± 0.67 months following distal triceps repair; however, 8 patients (88.9%) held light or sedentary occupations. Thus, comparing these results with those of patients who did not undergo prior surgery on the ipsilateral elbow may be limited.

Patients who held sedentary-, light-, moderate-, and heavy-intensity occupations were able to return to their previous level of occupational intensity at a rate of 100.0%, 100.0%, 80.0%, and 76.9%, respectively, at a duration of 0.3 ± 0.5 months, 1.8 ± 1.5 months, 2.5 ± 3.6 months, and 4.8 ± 3.9 months, respectively (Table IV). Patients in higher-intensity occupations had a lower rate of RTW ($P = .01$) and took longer to RTW than patients in lower-intensity occupations ($P < .001$).

On multivariate binomial logistic analysis, body mass index (odds ratio [OR], 1.02 [95% confidence interval (CI), 0.96-1.55]; $P = .03$), age (OR, 0.99 [95% CI, 0.98-0.999]; $P = .03$), and workers' compensation status (OR, 0.76 [95%

Table II Patient demographic characteristics

Variable	Data
Age at time of surgery, mean ± SD, yr	46.0 ± 10.7
Follow-up duration, mean ± SD, yr	5.9 ± 3.9
Body mass index, mean ± SD, kg/m^2	30.3 ± 4.2
Duration of injury to surgery, mean ± SD, mo	4.3 ± 8.9
Duration of injury to surgery, n (%)	
<3 mo	48 (67.6)
3-6 mo	9 (12.7)
6-12 mo	8 (11.3)
>12 mo	6 (8.5)
Sex, n (%)	
Female	70 (94.6)
Male	4 (5.4)
Dominant extremity, n (%)	
Right	70 (94.6)
Left	2 (4.1)
Both	1 (1.4)
Operative side, n (%)	
Right	37 (50.0)
Left	31 (41.9)
Both	6 (8.1)
Operation on dominant extremity, n (%)	43 (58.1)
Workers' compensation, n (%)	20 (27.0)

SD, standard deviation.

Table III Operative details

Variable	n (%)
Degree of tear	
Partial	45 (60.8)
Full	29 (39.2)
Tear location	
Tendinous insertion	45 (60.8)
Avulsion	26 (35.1)
Not specified	3 (4.5)
Operative technique	
Transosseous bone tunnel repair	24 (32.4)
Suture anchor repair	19 (25.7)
Primary suture repair	31 (41.9)

CI, 0.66-0.88]; $P < .001$) were risk factors for not returning to work. Primary surgery (OR, 1.21 [95% CI, 1.03-1.42]; $P = .02$) was associated with a greater likelihood of returning to work. However, degree of tear, location of tear, mechanism of injury, operative technique, surgery on the dominant extremity, duration of injury to surgery, and occupational intensity were not predictors of the ability to RTW ($P > .05$).

A multiple linear regression was calculated to predict the duration of RTW based on demographic and operative variables. Patients took 0.87 months (95% CI, 0.32-1.41 months; $P = .002$) longer to RTW with increasing occupational intensity and took 2.1 months (95% CI, 0.44-3.75 months; $P = .01$) longer to RTW if they had workers' compensation designation. Body mass index, age, primary surgery, degree of tear, location of tear, mechanism of injury, operative technique, surgery on the dominant extremity, and duration of injury to surgery were not predictors of the duration until RTW ($P > .05$).

Postoperative outcomes

The average postoperative MEPS, QuickDASH score, and VAS pain score were 89.6 ± 14.9, 7.3 ± 12.9, and 2.0 ± 1.8, respectively. Additionally, patients rated their elbows as 83.6% ± 24.4% of normal compared with their preinjury

Table IV Rate and duration to RTW at same level of occupational intensity

	Working before surgery, n	Working after surgery, n	Rate of RTW, %	Average time to RTW, mo
Sedentary	29	29	100	0.3 ± 0.5
Light	7	7	100	1.8 ± 1.5
Moderate	10	8	80.0	2.5 ± 3.6
Heavy	26	20	76.9	4.8 ± 3.9
Total	74	66	89.2	2.2 ± 3.2

RTW, return to work.

state. Of the patients, 71 (95.9%) were at least somewhat satisfied with their surgical procedure, with 50 patients (67.6%) reporting excellent satisfaction. Furthermore, 70 patients (94.6%) noted at least ''a little improvement'' in their quality of life following distal triceps repair. Four patients (5.4%) noted no improvement in their quality of life, and no patients reported that their quality of life worsened following surgery. Moreover, 67 patients (90.5%) were at least somewhat satisfied with the cosmetic appearance of their surgical site and 72 patients (97.3%) stated that they would undergo the operation again if presented the opportunity to alter their decision. Finally, 7 patients (9.5%) returned to the operating room at least once following distal triceps repair, with a single patient (1.4%) undergoing revision distal triceps repair.

Discussion

In this investigation, we demonstrated that 93.2% of patients returned to their previous level of occupational intensity by 2.2 ± 3.2 months after distal triceps repair, with 89.2% of patients able to return to the same level of occupational intensity. Patients in higher-intensity occupations took longer to RTW than those in lower-intensity occupations. Because distal triceps repair is commonly performed in younger, active patients, who comprise the majority of the workforce, it is important that physicians adequately counsel patients on work outcomes to manage postoperative expectations.

RTW is an important metric following elective orthopedic procedures as employment leads to higher self-esteem, a sense of purpose, and overall improved mental health.[23,25] However, information regarding RTW after distal triceps repair is lacking. In a previous study, 94% of active military members were able to return to active duty following distal triceps repair, with 13% of patients experiencing traumatic rerupture of the distal triceps tendon.[5] Of the patients experiencing reinjury, 66.7% were able to resume their military careers following revision or nonoperative management. In our investigation, 93% of patients returned to work after distal triceps repair; however, patients in higher-intensity occupations had a lower rate of RTW (76.9%). In contrast to the civilian population, military service members have higher activity requirements and responsibilities that may not be amenable to standard postoperative care and rehabilitation. However, the military population is fundamentally different owing to the resilience and camaraderie within its work culture; in addition, military service members' continued employment is contingent on their physical well-being.[5] Therefore, it may be unreasonable to extrapolate the findings among military members to the general population.

In comparison to other tendinous injuries at the elbow, 94% of patients were able to RTW by 14 weeks following distal biceps repair.[22] Furthermore, only 89% of patients returned to their previous level of occupational intensity.[22] Our patients undergoing distal triceps repair had a similar rate of RTW (93%) and return to preoperative occupational intensity (89%); however, they returned to work earlier than the previous patients undergoing distal biceps repair (2.2 months vs. 3.5 months). It is possible that the current investigation included a higher proportion of patients with sedentary occupations than what may be typical in distal biceps repair populations. It is unclear how many patients included in the review by Rubinger et al[22] held heavy-intensity occupations. Workers' compensation status may be a factor as well. In our study, 75% of workers' compensation patients were able to return to their previous occupation by 6.5 ± 4.3 months postoperatively compared with 100.0% of non–workers' compensation patients at 1.1 ± 1.6 months. Similarly, Atanda et al[4] demonstrated that workers' compensation patients took longer to RTW (3.95 months) than non–workers' compensation patients (1.35 months). Occupational injuries and workers' compensation status may negatively affect RTW outcomes for patients undergoing tendinous repair of the shoulder and elbow.[4,14] Although there were variations in the rehabilitation protocols among the surgeons included in this investigation, patients were prohibited from participating in active elbow extension and were not allowed to significantly flex the elbow for much of the first 6 weeks postoperatively. This significant restriction, coupled with the delay in beginning strengthening, allows patients with sedentary- or light-intensity occupations the opportunity to return to their regular occupations sooner than patients with higher-intensity occupations. Physicians

should be aware of these data on differential RTW rates and the timing of return for various types of occupations and counsel patients accordingly.

The optimal operative technique for distal triceps repair has yet to be elucidated as various studies have shown adequate functional outcomes using transosseous bone tunnel repair, suture repair, or suture anchor placement.[5,6,13,15,17,27,28] In a biomechanical analysis, transosseous-equivalent suture anchor repair best reconstituted the anatomic footprint of the distal triceps and yielded the least amount of displacement at the repair site in comparison to transosseous tunnel repair and single-row suture anchor repair.[30] However, there was no difference in the ultimate failure load between the repair techniques. Patients treated with transosseous tunnel repair have lower Disabilities of the Arm, Shoulder and Hand scores, higher rates of rerupture and reoperation, and a longer duration of postoperative care than patients treated with suture anchor repair.[15,21] However, Waterman et al[28] demonstrated no difference in complications between transosseous bone tunnel repair, suture repair, and suture anchor placement. In our investigation, multivariate binomial logistic regression and multivariate linear regression demonstrated no difference in the rate or duration of RTW among the operative techniques. The results of this investigation and previous investigations suggest that there is no evidence that clearly supports one surgical technique over the others for distal triceps injuries at this time.

The analysis of this investigation should be interpreted within the context of its limitations. The external validity of this investigation may be limited because of differences in patient demographic characteristics or specific occupational demands. Including patients who underwent previous elbow surgery creates heterogeneity and may impact the results of the investigation. With the majority of patients holding sedentary occupations, the duration of RTW may be skewed to be earlier. However, the rate and duration of RTW were calculated for each occupational intensity and indeed demonstrated that patients with higher-intensity occupations took longer to RTW than those with lighter occupational demands. Furthermore, this was a retrospective study, which did not allow us to control for baseline demographic characteristics or to obtain preoperative outcome scores. The follow-up in this investigation is relatively short term, and the impact of continued participation in work on patient outcomes is not well understood. This investigation may result in recall bias. However, its design is identical to that of previous studies that examined RTW and satisfaction following orthopedic procedures.[1-3,9-12,16,18,19] This study is also subject to nonresponse bias as 28.3% of patients were lost to follow-up. The patients lost to follow-up may comprise a different patient population than the population of patients retained in the study, which may impact the results of our study. This investigation may also be subject to selection bias as operative indications and surgical techniques varied by surgeon. Motivation to RTW may be impacted by the social situation, economic need, comorbidities, disability coverage, and health insurance coverage of patients. However, the rationale for RTW was not investigated. Confounding variables such as anabolic steroid administration were not assessed and were unable to be controlled for in this investigation. The lack of postoperative radiographs inhibits the characterization of soft tissue calcification or secondary enthesophyte formation. Finally, standardized legacy patient-reported outcome measures, such as the QuickDASH score, MEPS, VAS pain score, American Shoulder and Elbow Surgeons score, and Single Assessment Numeric Evaluation score, were not assessed preoperatively and may limit the interpretation of our findings.

Conclusion

Approximately 93% of patients who underwent distal triceps repair returned to work by 2.2 ± 3.2 months postoperatively. Patients with higher-intensity occupations had an equivalent rate of RTW but took longer to return to their preoperative level of occupational intensity. Information regarding RTW is imperative in preoperative patient consultation to manage expectations.

Disclaimer

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