Adherence to therapy after flexor tendon surgery at a level 1 trauma center

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Abstract

Background Nonadherence to postoperative therapy protocols can adversely affect the outcome after flexor tendon surgery. In this study, we hypothesize that patients with partial or no insurance coverage for their aftercare are less likely to attend postoperative therapy sessions and have a higher incidence of a poorer outcome than those who have full insurance coverage. **Methods** We analyzed 159 patients with flexor tendon injuries at a level 1 trauma center. Demographic variables along with the clinical outcome data were collected and cross-tabulated. Associations among descriptive and clinical variables were assessed using Fisher's Exact tests and chi-square analyses. Comparisons for continuous variables were performed using the Kruskal-Wallis Test.

Results Eighteen patients (11.3 %) had an injury in zone 1, followed by 68 (42.8 %) in zone 2, 15 (9.4 %) in zone 3, 9 (5.7 %) in zone 4, 38 (23.9 %) in zone 5, and 11 (6.9 %) in zone 6. Patients completed 8.2 therapy sessions on average. Patients had state assistance program (40.3 %), private insurance (35.2 %), Medicaid/Medicare (11.3 %), worker's compensation (8.8 %) insurance, or paid themselves (13.2 %). Fifty-three

(33.3 %) patients had excellent outcomes, 46 (29 %) had good, 40 (25 %) had fair, and 20 (12.5 %) had a poor outcome. Patients responsible to pay for their aftercare were significantly less likely to be adherent to therapy and had poorer outcomes than those with full coverage.

Conclusion Patients responsible for the pay of their postoperative rehabilitation are less likely to participate in therapy and may be at a higher risk of having a poor outcome.

Keywords Flexor Tendon Repair · Therapy adherence · Outcomes · Insurance coverage · Payer source

Introduction

Adherence to scheduled therapy sessions has been the subject of extensive clinical scrutiny [2, 5, 7, 8, 10, 12, 13]. In our current health-care climate, demonstrating the clinical effectiveness of adherence to rehabilitation and therapy is a pertinent issue from a cost-effectiveness standpoint. Among many factors, the influence of payer source is well-established in adherence to aftercare [6]. Patients who have a third-party payer covering costs of their postoperative care are more likely to be adherent than those without a payer source [6]. Despite those findings, most studies have failed to show the impact of such influence on the overall functional outcome after flexor tendon surgery [2, 6, 13]. In this study, we aim to address whether the coverage of the therapy cost was associated with participation and whether nonadherence to aftercare has an impact on functional outcome after flexor tendon surgeries.

Patients and Method

Prior to data analysis, we obtained institutional review board approval. The demographic and clinical data from

Investigation was performed at Denver Health Medical Center, Denver, CO, USA.

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2003 to 2009 was collected for 159 patients with flexor tendon injuries, including single tendon, multiple tendon, and multiple digits, repaired by two attending hand surgeons. Patients with fractures, soft tissue loss, or any other bodily injury interfering with aftercare therapy protocols were excluded. We used a six-strand locking repair technique in all patients using 3.0 or 4.0 looped nylon suture (Supramid, S. Jackson Inc., Alexandria, VA). Both tendons were repaired in zone 2 injuries.

Patients with nerve injuries were left immobilized in a dorsal block splint at 90° of metacarpophalangeal (MP) flexion with wrist in neutral position. All other patients began active and active-assisted range of motion within the first week following surgery including place and hold exercises using dorsal block splinting. All patients had scheduled visits with the therapist within 3 weeks after the surgery. All patients were scheduled the same number and frequency of visits for the first 4 weeks of their treatment. Further modifications were made as the therapy progressed on an individual basis. Nonadherence to scheduled therapy visits was defined as a failure to attend two or more sessions during the postoperative period without rescheduling. Two certified hand therapists treated all patients and contacted each patient to find out the reason for nonadherence. Final follow-up was performed at a minimum of 6 months after the surgery. We collected demographic variables (age, sex, hand dominance, comorbidities, psychiatric history, smoking/alcohol/drug history, insurance status, employment status, level of education) on each patient along with injury characteristics, technique of repair, therapy modality, attendance status to therapy, and the outcome. Patients in state assistance program were responsible to pay a partial fee for each therapy session. Patients with private insurance and worker's compensation programs were covered by the insurance carrier. We evaluated the outcome on the basis of total active motion of the digit (the sum of active ROM of the MP, PIP, and DIP joints) and classified as excellent ($>150^\circ$ of motion), good ($125\text{--}149^\circ$), fair ($90\text{--}124^\circ$), or poor ($<90^\circ$) as described earlier [14]. Major complications including tenolysis, rupture, and infection were also noted.

Statistical Analyses

Descriptive statistics were performed to summarize demographic and clinical information. Data were cross-tabulated, and associations among descriptive and clinical variables were assessed using Fisher's exact tests and chi-square analyses. Correlations between the outcome and the number of therapy sessions were assessed using the Spearman-rho rank order correlation coefficient. Comparisons for continuous variables were performed using the Kruskal-Wallis test. Statistical analyses were performed using SPSS software.

Results

Patient and injury characteristics are summarized on Table 1. Final outcome and summary of major complications are listed on Table 2. Patients completed an average of 8.2 sessions of therapy (standard deviation = 13.0, range 0 to 80). Thirty-two patients were female (20.1 %) and 127 (79.9 %) were male with an average age of 34.7 years (range 18–74 years). Average time from injury to surgery was 12 days (range 0–30 days). Functional outcome based on the total active range of motion on various zones of injury are summarized on Table 3. Patients with poor or fair outcomes were less likely to be adherent than those with good or excellent outcomes ($p<0.001$).

Patients with an excellent outcome had significantly more hand therapy sessions than those in the good, fair, or poor outcome groups ($p<0.001$). Differences among the latter three groups were not significant ($p>0.05$ for all). On average, those in the excellent group had 16.7 sessions (median = 8 sessions), while

Table 1 Patient and injury characteristics

Patient demographics	
Age	34.7 (18–74)
Gender	32 (20.1 %) Female; 127 (79.9 %) Male
Insurance Status	
State assistance (SA)	64 (40.2 %)
Private insurance (PI)	48 (30 %)
Worker's compensation (WC)	8 (5 %)
Medicare-Medicaid (MM)	18 (11.3 %)
Self-pay (SP)	21 (13.2 %)
Comorbidities ^a	
Drug	19 (12.3 %)
Alcohol	68 (43.9 %)
Tobacco	72 (46.8 %)
Psychiatric history	19 (12.2 %)
Mechanism of Injury	
Clean-cut	118 (74.2 %)
Saw injury	22 (13.8 %)
Avulsion-rupture	6 (3.8 %)
Crush	11 (6.9 %)
Gunshot	2 (1.3 %)
Zone of Injury	
Zone 1	18 (11.3 %)
Zone 2	68 (42.8 %)
Zone 3	15 (9.4 %)
Zone 4	9 (5.7 %)
Zone 5	38 (23.9 %)
Zone 6	11 (6.9 %)

^a Percentages are based on the overall number of patients. Some patients had more than one comorbidity

Table 2 Overall final outcome and summary of major complications for patients treated

	Patients adherent to therapy (<i>n</i> =71)	Patients not adherent to therapy (<i>n</i> =88)
Outcome		
Excellent	38 (53.5 %)	15 (17 %)
Good	25 (35.5 %)	21 (24 %)
Fair	7 (10 %)	33 (37.5 %)
Poor	1 (1 %)	19 (21.5 %)
Complications		
Tenolysis	23 (14.4 %)	
Rupture	9 (5.6 %)	
Infection	1 (0.6 %)	

those in the good group had 6.6 (median = 5 sessions), those in the fair group 4.9 (median = 3 sessions), and those in the poor group 6.2 sessions (median = 1 session). A significant, moderate positive correlation was found between outcome and number of sessions ($r=0.369$, $p<0.001$). As number of sessions increased, patient outcomes also improved.

Patients who were not adherent to treatment recommendations were less likely to undergo tenolysis (6.8 % versus 24 %, $p=0.002$). This was likely related to noncompliant patients not seeking further care for tenolysis. Relations between compliance and rupture, second stage reconstruction, and “other complication” were not significant ($p>0.05$ for all).

No significant difference was found between insurance type and outcome ($p=0.10$). However, 50 % of those in the “excellent” outcome category had private insurance versus 39.9 % receiving state assistance, 4.3 % receiving Medicaid/Medicare, and 4.3 % who were in the self-pay category.

Approximately 80 % ($n=17$) of patients in the self-pay category were nonadherent compared to 61.1 % ($n=11$) in the Medicare/Medicaid, 53.0 % ($n=34$) in the state assistance program, and 45.8 % ($n=22$) in the private insurance category. Patients responsible for treatment costs were significantly less likely to comply with treatment recommendations than those with public, private, or Medicaid/Medicare coverage ($p=0.002$). Also, patients who were unemployed were less likely to be adherent to therapy than those that were employed ($p=0.004$). Finally, no significant associations were found between adherence and alcohol use ($p=0.142$), drug history ($p=0.467$), or psychiatric history ($p=1.000$).

Table 3 Distribution of cases, the functional outcome based on total active range of motion, and complications across various flexor tendon zones

Injury zone	Compliant patients <i>n</i> =71	Noncompliant patients <i>n</i> =88
Zone 1 (<i>n</i> =18)	Excellent: 6 Good: 2 (1 tenolysis) Fair: 0 Poor: 0	Excellent: 2 Good: 6 Fair: 2 Poor:
Zone 2 (<i>n</i> =68)	Excellent: 12 Good: 15 (10 tenolysis) Fair: 3 (2 tenolysis, 1 rupture) Poor: 0	Excellent: 2 Good: 6 Fair: 21 (1 tenolysis, 2 ruptures) Poor: 9 (3 tenolysis, 1 infection,)
Zone 3 (<i>n</i> =15)	Excellent: 0 Good: 0 Fair: 2 (2 tenolysis) Poor: 0c	Excellent: 0 Good: 3 Fair: 5 Poor: 4 (2 ruptures)
Zone 4 (<i>n</i> =9)	Excellent: 1 Good: 3 Fair: 1 (1 tenolysis) Poor: 0	Excellent: 0 Good: 0 Fair: 1 Poor: 3 (1 rupture)
Zone 5 (<i>n</i> =38)	Excellent: 14 Good: 5 (2 ruptures) Fair: 1 (1 tenolysis) Poor: 0	Excellent: 7 Good: 5 Fair: 3 (1 rupture) Poor: 3 (1 tenolysis)
Zone 6 (<i>n</i> =11)	Excellent: 5 Good: 0 Fair: 0 Poor: 0	Excellent: 4 Good: 1 Fair: 1 (1 tenolysis) Poor: 0

Discussion

Based on the data presented in this report, there appears to be a positive correlation between the adherence to therapy and paid aftercare or the payer status as well as the adherence to therapy and a successful outcome. These results not only underline the importance of skilled therapy but also demonstrate that patients with partial or no coverage for therapy are more likely to have a poorer outcome. Although we stressed the importance of participating in postoperative therapy to all patients, we noted that patients with partial or no coverage for the therapy ended up not participating as well as we had planned. We directly contacted each patient to find out reasons for nonadherence and documented mostly the following reasons: a lack of financial resources to pay for their co-payment, a lack of transportation, or the inability to take time off from work.

Nonadherence to therapy following flexor tendon surgery is assumed a poor prognostic indicator [2, 10]. The concept has not been tested in a prospective randomized trial as such a study could be harmful to a patients' function or quality of life; however, the prospective investigation of number of therapy visits a patient attends and function could be possible. Retrospective studies of nonadherence give us a unique opportunity to test and appreciate the value of the aftercare. The results therefore should be appropriately interpreted. Given the wide range of injuries treated at a level-1 hospital and the retrospective nature of this study, we were unable to control the specific injury characteristics between the two groups of patients (adherent versus nonadherent), which is an important determinant of outcome after flexor tendon surgery [1]. We also did not have enough power to stratify whether additional nerve injuries would have made an impact on the outcome based on patients' adherence. It is known that the zone of flexor tendon injury, type of injury, as well as patient's medical characteristics can affect surgical outcome [9, 11]. More than 200 factors [3, 4] have been documented as being related to adherence including the patient characteristics, the relationship between health-care professional and the patient, and the clinical setting; the examination of these variables was out of the scope of our study.

In conclusion, functional outcome following flexor tendon surgery is dependent on many factors including injury characteristics, which are not addressed in this study, limiting the interpretation of the results. Although majority (55 %) of the patients were nonadherent to scheduled therapy visits, 62 % of patients were within good to excellent range. It appears that the type of insurance coverage affects adherence to scheduled therapy sessions. Also, a positive correlation exist between

outcome and the number of therapy sessions for those in the excellent category.

Conflict of interest Kagan Ozer declares that he has no conflict of interest.

Serdar Toker declares that he has no conflict of interest.

Nikhil Oak declares that he has no conflict of interest.

Allison Williams declares that she has no conflict of interest.

Kyros Ipaktchi declares that he has no conflict of interest.

Statement on human and animal rights The authors declare that the study was performed in accordance to the ethical standards of the responsible committees on human experimentation.

Statement on informed consent The authors declare that appropriate informed consent was obtained from the patients in this study.

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