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Return to Sports and Physical Activities After Primary Partial Arthrodesis for Lisfranc Injuries in Young Patients

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Abstract

Background: Research regarding outcomes in sports and physical activities after primary partial arthrodesis for Lisfranc injuries has been sparse. The purposes of this study were to assess various sports and physical activities in young patients following primary partial arthrodesis for Lisfranc injuries and to compare these with clinical outcomes.

Methods: Patients who underwent primary partial arthrodesis for a Lisfranc injury were identified by a retrospective registry review. Thirty-eight of 46 eligible patients (83%) responded for follow-up at a mean of 5.2 (range, 1.0 to 9.3) years with a mean age at surgery of 31.8 (range, 16.8 to 50.3) years. Physical activity participation was assessed with a new sports-specific, patient-administered questionnaire. Clinical outcomes were assessed with the Foot and Ankle Outcome Score (FAOS).

Results: Patients participated in 29 different and 155 total physical activities preoperatively, and 27 different and 145 total physical activities postoperatively. Preoperatively, 47.1% were high impact, and postoperatively, 44.8% were high impact. The most common activities were walking, bicycling, running, and weightlifting. Compared to preoperatively, difficulty was the same in 66% and increased in 34% of physical activities. Participation levels were improved in 11%, the same in 64%, and impaired in 25% of physical activities. Patients spent on average 4.2 (range, 0.0 to 19.8) hours per week exercising postoperatively. In regard to return to physical activity, 97% of respondents were satisfied with their operative outcome. Mean postoperative FAOS subscores were significantly worse for patients who had increased physical activity difficulty.

Conclusion: Most patients were able to return to their previous physical activities following primary partial arthrodesis for a Lisfranc injury, many of which were high-impact. However, the decreased participation or increase in difficulty of some activities suggests that some patients experienced postoperative limitations in exercise. Future studies could compare sports outcomes between primary partial arthrodesis and open reduction internal fixation for Lisfranc injuries.

Level of Evidence: Level IV, retrospective case series.

Keywords: outcome studies, sports, trauma, Lisfranc injury, arthrodesis

Introduction

Lisfranc injury affects the tarsometatarsal (TMT) joint complex of the midfoot, which includes the TMT joints, the intermetatarsal ligaments, and the associated intercuneiform joints.[25] The injuries may be ligamentous, bony, or more frequently a combination of both, and range from non-displaced injuries to fracture dislocations of some or all of the TMT joints.[7] A number of treatment options are available, including closed reduction and immobilization, closed reduction with percutaneous pinning, trans-articular or extra-articular open reduction and internal fixation (ORIF), flexible ligamentous fixation, primary partial arthrodesis (leaving the fourth and fifth TMT joints unfused), and primary complete arthrodesis (involving all 5 TMT joints).[15,22]

Although primary ORIF has been advocated for the treatment of Lisfranc fracture dislocations,[1,17,20,21] some studies have provided support for primary partial arthrodesis. The latter has been suggested for purely ligamentous injuries, which have been shown to have worse outcomes than combined osseous-ligamentous injuries after ORIF in

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a retrospective study.[10] One Level I study showed better clinical outcomes in patients who underwent primary arthrodesis than those who underwent ORIF for primarily ligamentous injuries.[12] Another Level I study showed no difference in clinical outcomes between the 2 treatments in patients with acute TMT fractures or fracture dislocations, except for more subsequent operations after ORIF due to hardware removal.[8] A Level III study found that both purely ligamentous and combined osseous-ligamentous Lisfranc injuries yielded good clinical outcomes after primary partial arthrodesis.[22] These findings suggest that primary partial arthrodesis is a feasible treatment option for both combined and ligamentous Lisfranc injuries.

Research regarding the long-term outcomes of Lisfranc injury relating to athletic activity has been sparse. Several studies investigate the treatment outcomes for Lisfranc injury in athletes, but they primarily consist of low-impact, minimally to mildly displaced Lisfranc injuries incurred during sport.[3,5,6,11,18,19,23] These studies also largely consist of either nonoperative treatment or ORIF. There are no studies to date that evaluate either recreational or elite athletes who have suffered more severe, significantly displaced or comminuted high-impact Lisfranc injuries.[16] Although some studies have assessed return to general leisure or physical activity after primary partial arthrodesis for Lisfranc injury,[12,22] none have systematically evaluated the specific sports and physical activities that patients return to postoperatively.

The long-term outcome of primary partial arthrodesis on sports participation after Lisfranc injury therefore remains unclear. The purpose of this study was to provide a retrospective, sports-focused outcomes analysis of primary partial arthrodesis for Lisfranc injury based on patient assessment. Specifically, it sought to evaluate outcomes in a young cohort of patients with respect to athletic activities, and to determine if these outcomes were associated with clinical outcomes based on a validated patient-rated outcomes measure. Our hypothesis was that patients would be able to participate in a variety of sports and physical activities postoperatively, including high-impact ones.

Methods

Patient Cohort

All patients who underwent primary partial arthrodesis for a Lisfranc injury between January 2006 and April 2014 by 1 of 7 fellowship-trained foot and ankle surgeons were identified using a prospective, institutional review board–approved foot and ankle registry at the investigators' institution. The registry consists of demographic, clinical, and operative patient data. A search was performed for the International Classification of Diseases (ICD-9) codes for TMT joint dislocation (838.03) and midtarsal joint dislocation (838.02), together with the Current Procedural Terminology (CPT) codes for open treatment of TMT joint dislocation (28615) and midtarsal arthrodesis (28740) or TMT arthrodesis (28730). Operative notes were subsequently reviewed to identify eligible patients.

Inclusion criteria were primary partial arthrodesis for a Lisfranc injury (within 6 weeks of injury), minimum 1-year follow-up, and age less than 50 at surgery to identify more active patients. Exclusion criteria were other hindfoot or ankle injuries, as these might have had a confounding effect on patient outcomes. Lisfranc injuries were fused either in cases of purely ligamentous or combined osseous-ligamentous injury.

Patients were called and emailed by their attendings and research assistants for enrollment in the study. Forty-six patients were identified who met inclusion and exclusion criteria. Of these, 38 (83%) were reached for follow-up and consented to take part in the study. The patient cohort was composed of 20 males and 18 females with a mean age at surgery of 31.8 (range, 16.8 to 50.3) years, and a mean follow-up time of 5.2 (range, 1.0 to 9.3) years. Mechanisms of injury included motor vehicle accident (n=8), twisting injury (n=16), fall (n=13), and crush injury (n=1). Six patients (16%) had ligamentous Lisfranc injuries, defined as an isolated avulsion of the Lisfranc ligament from the base of the second metatarsal (MT), and the remaining 32 (84%) had combined osseous-ligamentous injuries, defined as ligamentous injuries with associated fractures of the MT bases, cuneiforms, or cuboid.[22] There were no significant differences found in sex, age, number of TMT joints fused, or follow-up time between the 2 injury cohorts with the numbers available (Table 1).

Two patients had fusions of the first TMT joint alone, 10 had fusion of the first and second TMT joints, and 24 had fusion of the first through third TMT joints. Two patients had fusion of the middle and medial cuneiform and 1 patient had the first TMT fusion extended to the navicular-medial cuneiform junction. Eight patients had associated cuneiform fractures and 1 had an associated cuboid fracture. Five patients had ORIF of the fourth and fifth TMT joints and 4 had ORIF of the fourth TMT joint.

Surgery

Each surgeon utilized similar techniques for joint preparation, fixation, and postoperative management. An intraoperative stress test was routinely performed with direct visualization or with fluoroscopy to determine instability. Demonstration of instability led to operative fusion. The TMT joints were also fused if significant comminution was noted upon further inspection. Arthrodesis was performed using either a single incision or dual dorsal incisions. After the articular cartilage was denuded, fixation of the first TMT was achieved using two 3.5-mm or 4.0-mm fully threaded cortical screws drilled for compression. Arthrodesis

Table 1. Demographic and Clinical Information by Injury Type.

	Combined Osseous-Ligamentous (n = 32)	Ligamentous (n = 6)	*p*-Value
Females[a]	15 (46.9)	3 (50)	>.999
Age[b]	31.6 (16.8-50.3)	32.5 (18.6-42.3)	.764
No. of TMT joints fused[c]	3 (1-3)	2 (1-3)	.121
Follow-up time[b]	5.3 (1.1-8.9)	4.4 (1.0-9.3)	.347

[a]Data presented as number of patients (percentage of injury cohort).
[b]Data presented as mean (range) in years.
[c]Data presented as median (range) in years.

of the second to third TMT joints was performed in a similar manner with either one or two 2.7-mm or 3.5-mm fully threaded cortical screws or locking compression plates. Bone graft from the calcaneus was also routinely used in a shear-strain relief pattern. Intercuneiform fusion was achieved with 3.5-mm or 4.0-mm fully threaded cortical screws. In cases of fourth and/or fifth MT dislocation, they were reduced and pinned with temporary Kirschner wires.

Postoperative Management

Patients had routine clinical follow-ups at 2 weeks, 6 weeks, 3 months, 6 months, and 1 year after the procedure, including x-rays. At the time of surgery, patients were placed in a posterior splint. The splint and sutures were removed 2 weeks after surgery, and patients were transitioned to a controlled ankle motion (CAM) boot or cast. They remained nonweightbearing until 6 weeks postoperatively but were instructed to begin active ankle range of motion. Patients who had fourth and/or fifth TMT joints fixed with Kirschner wires had the wires removed at 6 weeks postoperatively. At this time, patients commenced progressive weightbearing in the CAM boot as well as a physical therapy. At 8 weeks postoperatively, weightbearing continued to advance and gait, balance, and proprioceptive training started. At 3 months postoperatively, low-impact activities were gradually allowed, and at 6 months postoperatively, patients were allowed to participate in high-impact activities.

Sports and Physical Activities

Sports and physical activities were assessed with a retrospective Sports-specific Questionnaire (SQ) which was emailed to patients at follow-up. The SQ asked patients whether they participated in any of 14 different sports and physical activities pre- and postoperatively, which included common low- and high-impact activities (Table 2). Patients were also asked to list the up to 3 most important physical activities they participated in pre- and/or postoperatively, including ones not provided on the list (patient-specific physical activities). All sports and physical activities were later classified as either high- or low-impact.[4,9] Patients were asked about their participation levels in each of the patient-specific physical activities, including sessions per week and minutes per session pre- and postoperatively. Frequencies of greater than 7 sessions per week and of more than 120 minutes per session were counted as 8 sessions and 130 minutes for analysis, respectively. Preoperative physical activity participation time was not reported, as this measure was likely to have been significantly affected by recall bias because of the duration of follow-up. Patients were asked whether each patient-specific physical activity was currently more difficult, less difficult, or the same as preoperatively, and whether their level of participation in each patient-specific physical activity was improved, impaired, or the same as preoperatively. The SQ also asked whether or not patients were satisfied with their surgery overall in regard to return to sports and physical activities, and allowed patients to provide additional comments regarding their recovery in an open-ended section at the end of the questionnaire. Each patient's postoperative level of physical activity was subsequently categorized into 1 of 4 grades, based on a modification of a previous classification system[24]: grade 0, sedentary (0 hours of physical activity/week); grade 1, moderately active (greater than 0 to 5 hours of physical activity/week); grade 2, highly active

Table 2. Sports and Physical Activities Provided on Sports Questionnaire.

Sport	Impact
Basketball	High
Bicycling	Low
Dancing/aerobics	High
Football	High
Golf	Low
Hockey	High
Lacrosse	High
Running	High
Soccer	High
Squash	High
Swimming	Low
Tennis	High
Walking	Low
Weightlifting	High

(greater than 5 to 10 hours of physical activity/week); or grade 3, extremely active (greater than 10 hours of physical activity/week).

Clinical Outcomes

Complications assessed included nonunion, malunion, deep wound infection, nerve damage, and adjacent joint arthritis. Clinical outcomes were assessed with the Foot and Ankle Outcome Score (FAOS), which was collected at follow-up together with the SQ. The FAOS has previously been validated for hallux valgus, for which many patients had arthrodesis of the first TMT,[2] as well as in other foot and ankle conditions.[13,14] It consists of 5 subscales: Pain, Symptoms, Quality of Life (QOL), Activities of Daily Living (ADL), and Sports. The subscores were summed and normalized to obtain a value between 0 and 100 for each subscale, with 0 being the worst and 100 the best clinical outcome.

Statistical Methods

Descriptive statistics are presented as means and ranges or 95% confidence intervals for continuous variables and frequencies and percentages for categorical variables. Differences in sex and number of joints fused between patients with combined or ligamentous injuries were assessed with Fisher exact tests. Differences in age and follow-up time between patients with combined or ligamentous injuries were assessed with Mann-Whitney *U* tests. The number of patients who returned to at least their preoperative physical activity levels, as defined by those who rated their physical activity level for every patient-specific activity as the same or improved postoperatively from preoperatively, was calculated. The association between FAOS subscores and patient ratings of pre- to postoperative changes in physical activity difficulty (less, same, or more) was assessed with generalized estimating equations (GEEs), taking into account the repeated measures for each patient (for the up to 3 patient-specific physical activities listed). Parallel analyses were conducted to assess differences in FAOS subscores and changes in physical activity participation level (improved, same, or impaired). Similar repeated measures GEEs but with cumulative logit link functions were used to assess whether the ratings of changes in physical activity levels were associated with injury type (combined or ligamentous) or activity impact (high or low). All statistical tests were conducted with SAS 9.3 (Cary, NC) with a level of significance of .05.

Results

Complications

There were no cases of nonunion, malunion, deep wound infection, or nerve damage. One patient (3%) developed medial and lateral intercuneiform arthritis. Five patients (13%) underwent removal of hardware.

Sports Questionnaire

Patients participated in 29 different and 155 total physical activities preoperatively, and 27 different and 145 total physical activities postoperatively. There were 77 patient-specific activities listed. Preoperatively, 47.1% of total physical activities (73/155) were high impact, and postoperatively, 44.8% (65/145) were high impact. The most common activities both pre- and postoperatively were walking, bicycling, running, and weightlifting. After surgery, 13 physical activities were discontinued in 9 patients, and 3 were initiated in 3 patients. Eight of the discontinued activities were high impact (Table 3). Four activities were discontinued because of lifestyle factors separate from the injury: 1 patient discontinued soccer because she was currently coaching and no longer competing in it, another patient discontinued soccer because he was no longer in college, 1 patient discontinued football because he was no longer in high school, and the patient who discontinued skiing cited this as due to being at a less active stage of his life.

Compared to preoperatively, 66% (49/74) of patient-specific physical activities were rated as the same in difficulty and 34% (25/74) were rated as more difficult postoperatively. No activities were rated as having decreased difficulty. There were no associations found between injury type ($P = .686$) or physical activity impact level ($P = .822$) and change in physical activity difficulty. Patients rated their participation levels as improved in 11% of patient-specific physical activities (8/74), the same in 64% (47/74), and impaired in 26% (19/74). There were no associations between injury type ($P = .598$) or physical activity impact level ($P = .935$) and change in physical activity participation level.

Thirty-seven of the 38 patients (97%) were active in sports and physical activities preoperatively. Of these, 24 (65%) returned to at least their preoperative physical activity participation levels. Patients spent on average 4.2 (range, 0.0 to 19.8) hours per week exercising postoperatively, with a mean of 2.2 (range, 0.0 to 8.0) sessions per week and 44.3 (range, 0.0 to 130.0) minutes per session. Postoperatively, 1 patient (3%) was sedentary, 27 patients (71%) were moderately active, 6 patients (16%) were highly active, and 4 patients (10%) were extremely active (Table 4). Two patients were professional athletes. One was a lacrosse player and rated that sport as more difficult postoperatively, but ironically had an improved level of participation. The other was a professional weightlifter and did not comment on the difficulty of that physical activity or of mixed martial arts, his other patient-specific activity; however, he rated improved participation in both postoperatively.

Table 3. Pre- and Postoperative Sports and Physical Activities.[a]

Impact	Sport	Preop. No. of Participants	Preop. % of Study Cohort (n = 38)	Postop. No. of Participants	Postop. % of Study Cohort (n = 38)	Discontinued Postop.	Started Postop.	Change
Low	Walking[b]	27	71	27	71	0	0	0
Low	Bicycling[b]	23	61	24	63	−1	2	1
High	Running[b]	17	45	16	42	−1	0	−1
High	Weightlifting[b]	17	45	15	39	−2	0	−2
Low	Swimming[b]	9	24	9	24	0	0	0
High	Basketball[b]	7	18	7	18	0	0	0
Low	Golf[b]	6	16	6	16	0	0	0
High	Dancing/aerobics[b]	5	13	5	13	0	0	0
High	Tennis[b]	5	13	5	13	0	0	0
Low	Total body conditioning	4	11	4	11	0	0	0
Low	Elliptical machine	3	8	3	8	0	0	0
High	Soccer[b]	5	13	3	8	−2	0	−2
High	Football[b]	3	8	2	5	−1	0	−1
High	Lacrosse[b]	2	5	2	5	0	0	0
Low	Snowboarding	3	8	2	5	−1	0	−1
Low	Spinning	1	3	2	5	0	1	1
High	Volleyball	4	11	2	5	−2	0	−2
Low	Yoga	3	8	2	5	−1	0	−1
Low	BMX biking	1	3	1	3	0	0	0
High	Circuit training	1	3	1	3	0	0	0
High	Hockey[b]	1	3	1	3	0	0	0
High	Mixed martial arts	1	3	1	3	0	0	0
High	Rock climbing	1	3	1	3	0	0	0
High	Rollerblading	1	3	1	3	0	0	0
High	Skateboarding	1	3	1	3	0	0	0
High	Squash[b]	1	3	1	3	0	0	0
High	Ultimate Frisbee	1	3	1	3	0	0	0
Low	Hiking	1	3	0	0	−1	0	−1
Low	Skiing	1	3	0	0	−1	0	−1
Total	29	155		145		−13	3	−10

Abbreviations: postop., postoperative/postoperation; preop., preoperative/preoperation.
[a]Patients could indicate participation in multiple sports and physical activities.
[b]Sports and physical activities provided on Sports Questionnaire.

Table 4. Postoperative Physical Activity Grades.

Grade	Hours of Exercise/ Week	No. of Patients	% of Study Cohort (n = 38)
0 (inactive)	0	1	3
1 (moderately active)	>0 and ≤5	27	71
2 (highly active)	>5 and ≤10	6	16
3 (extremely active)	>10	4	10

Ninety-seven percent of patients (35 of 36 responding) were satisfied with surgery with regard to return to physical activities. The 1 patient who was dissatisfied experienced increased pronation and loss of midfoot range of motion postoperatively, which caused asymmetries, misalignment, and pain in his knees, trunk, shoulders, neck, and jaw.

FAOS

The mean postoperative FAOS subscores were: Pain, 91.4 (range, 47.2 to 100.0); Symptoms, 87.6 (range, 53.6 to 100.0); ADL, 95.9 (range, 52.9 to 100.0); Sports, 85.8 (range, 20.0 to 100.0); and QOL, 75.5 (range, 25.0 to 100.0). FAOS subscores showed no associations with injury type, physical activity impact level, or change in participation level. Patients who rated their physical activities as more difficult postoperatively than preoperatively had lower FAOS subscores than patients who rated their physical activities as the same in difficulty ($P \leq .017$) (Figure 1).

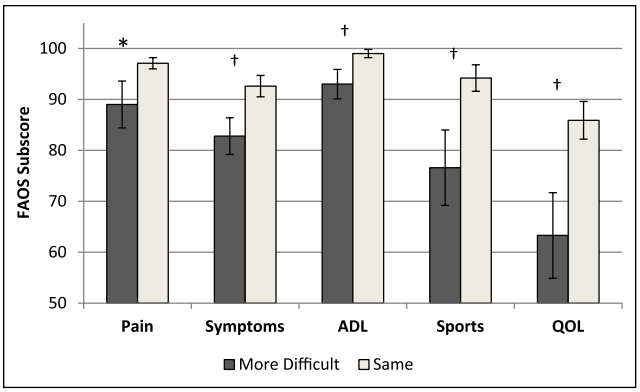

Figure 1. Mean postoperative Foot and Ankle Outcome Score (FAOS) subscores stratified by pre- to postoperative difficulty change in sports and physical activities. Error bars indicate 95% confidence intervals. Patients who rated their physical activities as more difficult had lower FAOS subscores than patients who rated their physical activities as the same in difficulty. *P = .017, †$P \leq .006$.

Discussion

This study investigated return to sports and physical activities in a young patient cohort after primary partial arthrodesis for Lisfranc injuries. We found that patients were able to return to most of their previous sports and physical activities at follow-up, including high-impact ones. However, they experienced increased difficulty and impaired participation levels in a third and a quarter of physical activities, respectively. All responding patients except 1 were satisfied with surgery with regard to return to physical activities. Patients who experienced increased difficulty in their physical activities had lower FAOS subscores. We found no differences in sports or clinical outcomes between patients with combined or purely ligamentous Lisfranc injuries. Strengths of this study include the high response rate, the young patient cohort (reflecting an athletically active group), and the long-term mean duration of follow-up.

There are several limitations to this study. Since it was retrospective, there may have been response bias, in which patients with worse outcomes did not respond to follow-up, although there was a high response rate of 83%. There may also have been recall bias, in which patients did not accurately remember their relative participation levels in or comparative difficulty of preoperative physical activities. We attempted to mitigate this by excluding some of the preoperative participation data from the analysis. The majority of our patients sustained combined osseous-ligamentous Lisfranc injuries (84%), so our study may have been underpowered to detect differences in outcomes by injury type. The FAOS has not been validated in patients with Lisfranc injuries, but it has been validated in a study assessing hallux valgus, in which many patients had first TMT fusion.[2] Also, the SQ has not been validated and only allowed patients to note participation times and pre- to postoperative changes in participation and difficulty in up to 3 physical activities. Although operative techniques and postoperative protocols were similar among the 7 orthopaedic surgeons, differences in their treatment methods and thus the outcomes of their patients are possible. In addition, there was no comparison group of patients who underwent ORIF for Lisfranc injuries.

Our findings show that patients were able to return to most of their preoperative sports and physical activities, many of them high-impact, suggesting that arthrodesis is a viable option for young, active patients with Lisfranc injures. However, a quarter of patients were unable to return to their preoperative activity levels. This indicates that limitations in physical activity may remain in some cases. The finding that physical activity impact level was not associated with changes in difficulty or participation level suggests that patients are not more limited in activities that place a higher load on the foot. This is supported by our finding that after accounting for activities discontinued due to lifestyle factors separate from the surgery, there were nearly equal numbers of high- and low-impact sports and physical activities discontinued postoperatively (5 and 4, respectively).

There was a high rate of satisfaction with surgery in regard to return to physical activity, despite the limitations in difficulty and participation levels. This suggests that these limitations were minor, and that patients were happy with their degree of return to sports and physical activities. Similarly, FAOS subscores demonstrated excellent clinical outcomes on average. The lower FAOS subscores for patients with increased physical activity difficulty suggests that those patients had worse outcomes in other spheres, including pain, symptoms, ADL, and QOL, in addition to sports. It is thus likely that in these cases, arthrodesis for Lisfranc injury does not only limit sports and physical activity. Overall, patients showed high levels of physical activity at follow-up, with a mean of 4.2 and a maximum of 19.8 hours per week, suggesting that arthrodesis is not prohibitive of high participation levels in sports and physical activities.

We found similar sports and physical activity outcomes, as well as clinical outcomes, in patients who had combined osseous-ligamentous and in those who had purely ligamentous Lisfranc injuries. This suggests that arthrodesis is a viable treatment option for both types of injuries. However, further studies should be done with greater numbers of patients in each injury group to confirm this finding.

TMT arthrodesis has previously not been recommended for professional athletes, as the maintenance of medial column motion has been suggested to be necessary for their full return to function.[16] In a study by Vertullo and Nunley, a questionnaire sent to members of the American Orthopaedic Foot & Ankle Society (AOFAS) assessed their opinions on return to sports participation after various types

of arthrodesis. Of the 103 surgeons who responded (a 20.6% response rate), 97% recommended return to professional golf or skiing, 84% recommended return to tennis, 76% recommended return to jogging, 54% recommended return to running, 64% recommended return to football, 69% recommended return to soccer, and 62% recommended return to basketball after arthrodesis for a Lisfranc injury.[18] Our study primarily evaluated recreational athletes, but we found high rates of return to most of these sports. Although our numbers were not large enough to assess statistical significance in each sport, they show that partial TMT arthrodesis does not preclude participation in them, which surgeons can take into consideration when advising their patients about postoperative outcomes.

Past studies have investigated return to preoperative physical activity levels following arthrodesis for Lisfranc injury as a secondary outcome. Reinhardt et al evaluated the outcomes of primary partial arthrodesis in 25 patients with ligamentous and combined injuries and found that after an average of 42 months, they were able to return to an average of 85% of their preinjury activity level. At follow-up, 3 patients with ligamentous injuries were unable to participate in skiing, soccer, or modern dance, and 4 patients with combined injuries were unable to participate in skiing, hiking, running, or dance because of the function of their foot. Eighteen patients (72%) were not limited in any activities in that study,[22] which is close to the 65% rate of return to preoperative activity levels found in ours. A study by Ly and Coetzee found that 21 patients with ligamentous Lisfranc injuries treated with arthrodesis recovered to an average of 86% of their preinjury level of physical or sports activity at 1 year, and to 92% at 2 years.[12] These rates are higher than that of 65% found in our study, which may be because we assessed return to preoperative physical activity levels based on a number of individual sports, whereas in Ly and Coetzee's study it was based on one general question regarding return to previous physical activity. Moreover, we systematically focused on sports and physical activity participation after primary Lisfranc arthrodesis, which no prior studies have done.

In conclusion, this is the first study to assess participation in specific sports and physical activities after primary arthrodesis for Lisfranc injuries in young patients. Patients were able to continue participation in most sports and physical activities, including high-impact activities, and most were satisfied with surgery in this regard. However, the decreased participation and increased difficulty in a number of activities suggests that some patients experience limitations in physical activity participation postoperatively. Surgeons can use this information to counsel patients regarding postoperative expectations in sports and physical activities following primary partial arthrodesis for Lisfranc injuries. Future studies can evaluate return to sports and physical activities in patients after ORIF to help elucidate whether a certain treatment allows for better outcomes in this regard.

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