Journal of the Pediatric Orthopaedic Society of North America 9 (2024) 100114

Contents lists available at ScienceDirect

Journal of the Pediatric Orthopaedic Society of North America

journal homepage: www.jposna.com

Original Research

Management of Syndesmotic Ankle Injuries: Results of a Survey of Pediatric Orthopaedic Society of North America Members

Caroline E. Williams, MD[1]; Blair Stewig, BS[1]; Sang Won Lee, MS[1,2]; Danielle Cook, MA[1]; Benjamin J. Shore, MD, MPH, FRCSC[1,2]; Collin J. May, MD, MPH[1,2,*]

[1] *Department of Orthopedic Surgery, Boston Children's Hospital, Boston, MA, USA*
[2] *Harvard Medical School, Boston, MA, USA*

ARTICLE INFO

Keywords:
Ankle syndesmosis injuries
Survey
Suture-button implant
Syndesmosis screw implant
Pediatric orthopaedic trauma

ABSTRACT

Background: Although utilization of dynamic suture-button fixation for adult syndesmotic injuries has shown improved outcomes over static screw fixation, data in pediatric populations is limited. This study evaluated trends in management and identified factors influencing surgeon choice of implant for pediatric syndesmotic injuries.
Methods: The Pediatric Orthopaedic Society of North America (POSNA) members were surveyed regarding syndesmotic injury implant preferences between October 2021 and May 2022. Respondents that opted out, treated <1 syndesmotic ankle injury in the past year, or had conflicting financial obligations were excluded. Results were summarized and analyzed using logistic regression to assess for significance between years posttraining and technique preference. Odds ratios (OR) and 95% confidence intervals (CI) were calculated for significance (*P*-values<.05).
Results: Among 103 respondents to the survey (with 102 complete responses), 25% were <5 years posttraining, 24% between 5 and 10 years, 21% between 11 and 15 years, and 28% > 15 years posttraining. Twenty-four percent (24/102) preferred screw versus 76% (78/102) preferring suture-button implants for syndesmotic injuries. Members >15 years posttraining were 4.7 times more likely to prefer screw implants compared to members <5 years posttraining (OR = 4.7; 95% CI, 1.14–19.34; *P* = .03). Since starting their clinical practice, 62 respondents (60%) reported an implant preference change, with avoidance of secondary surgery (46/62; 74%) and extrapolation from adult outcomes (39/62; 63%) cited as primary motivating factors. Of the 40 members with no preference change, comfort with the procedure was the primary cited reason (33/40; 83%). Among those choosing operative intervention, radiograph-based cases showed preference for the suture-button in 70%–79% of respondents for skeletally mature patients versus 71%–81% for skeletally immature patients.
Conclusions: Our data shows that the shift over time from screw to suture-button implant fixation for pediatric and adolescent syndesmotic ankle injuries is largely due to interest in avoiding implant removal and extrapolation from superior outcomes seen with suture-button use in adults. Larger comparative studies of pediatric and adolescent patients treated with suture-button versus screw fixation are needed to establish standards of care for these challenging injuries.
Key Concepts:

(1) Literature for operative syndesmotic injury management in adults has shown improved outcomes of dynamic suture-button fixation over static screw fixation, but data in pediatric and adolescent populations is limited.
(2) A survey of 102 POSNA members shows that 76% prefer suture-button, 24% prefer screw fixation with members >15 years posttraining 4.7 times more likely to prefer screw fixation to members <5 years posttraining.
(3) Among 62 respondents who switched implant preference during their clinical practice, avoidance of secondary surgery and extrapolation from outcomes in adults were the two most cited reasons.
(4) Among 40 respondents who did not switch implant preference, comfort with the procedure was the most cited reason.
(5) Comparative studies of suture-button versus screw implants for treatment of pediatric and adolescent syndesmotic ankle injuries are needed to establish an evidence-based standard of care management.

Level of Evidence: Level V: Expert Opinion

* Corresponding author: Boston Children's Hospital, 300 Longwood Avenue, Boston, MA 02115, USA.
E-mail address: Collin.May@childrens.harvard.edu (C.J. May).

https://doi.org/10.1016/j.jposna.2024.100114
Received 21 April 2024; Received in revised form 20 July 2024; Accepted 28 July 2024
Available online 14 September 2024

Introduction

Ankle injuries are a commonly cited reason for pediatric sports medicine clinic visits, accounting for nearly 30% of visits by one estimate [1]. Syndesmotic injuries, also termed "high ankle sprains," refer to disruption of the supportive ligaments between the tibia and fibula, and are most frequently seen in sports characterized by cutting and pivoting movements such as football, soccer, skiing, and hockey [2,3]. Prior to the mid-2000s, syndesmotic injuries were treated almost exclusively with static screw fixation, placed across the fibula and into the tibia [4]. Since the dynamic suture-button technique was introduced in 2005, multiple systematic reviews and meta-analyses have shown superior results for suture-buttons in treatment of syndesmotic injury in adults in terms of functional outcome, complication rate, implant failure rate, reoperation rate, and time to weight bearing [5–13]. Two surveys of orthopaedic surgeons treating adult syndesmotic injuries have shown an increasing use of suture-button technique over time [14,15]. However, data comparing suture-button and screw fixation for syndesmotic injury in pediatric and adolescent patients has been limited, although initial studies have suggested lower rates of hardware removal with suture-button fixation [16]. Furthermore, to the authors' knowledge, no national survey of pediatric orthopaedic surgeons has been published to date examining the current practices for treating syndesmotic injuries.

The purpose of this study is to investigate syndesmotic injury management trends in pediatric and adolescent patients by conducting a physician-reported survey of a professional society wide sampling of pediatric orthopaedic surgeons. We hypothesize that there has been an increasing trend toward use of suture button fixation over screw fixation for operative treatment of pediatric and adolescent syndesmotic ankle injuries amongst pediatric orthopaedic surgeons. Furthermore, we aim to identify factors that could influence a surgeon's choice of implant for operative repair of the ankle syndesmosis in young patients.

Materials and methods

This was a cross-sectional survey composed of 46 questions that was created and reviewed by all authors and approved by the Pediatric Orthopaedic Society of North America (POSNA) evidence-based medicine committee. The survey was sent to all members of POSNA electronically via email. Responses were collected between October 1st, 2021 and January 24th, 2022 and stored and managed within Research Electronic Data Capture (REDCap) [17,18]. Orthopaedic surgeons who did not operatively treat pediatric syndesmotic injuries at least once annually, those with any financial or contractual obligations deemed to be conflicts of interest, and those unwilling to participate in the survey were excluded from the study.

The survey was divided into two sections: Section 1 included questions regarding surgeon demographics, implant preference, and challenges associated with operative management of pediatric syndesmotic injuries, and factors that contribute to management preference. Most questions were closed-ended multiple-choice queries permitting a single response with choice of "Other" response where appropriate with a comment field.

Section 2 involved questions on management preferences using specific case examples with x-ray images. Respondents were asked to evaluate tibia-fibula and ankle radiographs for four patient scenarios (Figs 2, 4, 6 and 8). For each of these cases, respondents were asked about their treatment preferences regarding the syndesmotic injury, their treatment preferences if the patient was instead skeletally immature (or mature depending on the case), and whether they would repair the deltoid ligament.

Survey results were summarized in tabular form using frequency and percent. Logistic regression analysis was used to determine if there were any associations between technique preference and various other factors: type of fellowship completed (orthopaedic subspecialty vs non-orthopaedic), number of fractures operated on per year, practice setting, and years posttraining of the respondent. Odds ratios (OR) were presented along with 95% confidence intervals (CI) for significant factors. *P*-values less than .05 were considered significant.

Results

One hundred and two members of the POSNA membership (102/1520, 6.7%) responded to the survey and were eligible based on the inclusion and exclusion criteria. One quarter of the respondents (26/102) were less than 5 years posttraining, 25% (25/102) were between 5 and 10 years, 22% (22/102) were between 11 and 15 years, and 28% (29/102) were more than 15 years posttraining (Table 1).

Twenty-four percent (24/102) of respondents preferred static screw(s) to treat pediatric and adolescent syndesmotic ankle injuries, and 76% (78/102) preferred a dynamic suture-button implant (Table 2). The concordance between screws being used in training and screws being the

Table 1.
Respondent characteristics ($N = 102$).

Question	Freq.	(%)
How many years are you posttraining? ($n = 102$)*		
<5 years	26	(25%)
5–10 years	25	(25%)
11–15 years	22	(22%)
>15 years	29	(28%)
Were both implants available at the start of your practice ($n = 100$)*		
Yes	54	(54%)
No	46	(46%)
Implant type used during training ($n = 102$)*		
Screw	66	(65%)
Suture button	4	(4%)
Both	32	(31%)
Fellowship training in ortho subspecialty ($n = 102$)*		
Yes	97	(95%)
No	5	(5%)
Specific subspecialty ($n = 97$)*		
Pediatric orthopaedics	72	(74%)
Pediatric orthopaedics and other	23	(24%)
Other only	2	(2%)
Practice setting		
Pediatric specialty hospital	65	(63%)
Tertiary care hospital	32	(31%)
General hospital	4	(4%)
Private clinic or nursing home	2	(2%)
Population of practice setting		
Metro	94	(91%)
Urban/rural	9	(9%)
Are both implants available where you practice? ($n = 102$)*		
Yes	99	(97%)
No	3	(3%)
Percentage of practice is peds/adolescent based		
26–50%	2	(2%)
51–75%	6	(6%)
>75%	95	(92%)

* *The number in parentheses represents the number of cases with information available for the given characteristic.*

Table 2.
Treatment preferences ($N = 102$).

Question	Freq.	(%)
What is your preferred technique? ($n = 102$)*		
Screw(s)	24	(24%)
Suture button	78	(76%)
Do you routinely remove the screws? ($n = 24$)*		
Yes	15	(63%)
No	9	(38%)
When do you remove the screw(s)? ($n = 15$)*		
Remove prophylactically	15	(100%)
How long after the primary operation do you remove the screws? ($n = 15$)*		
< 3 months after the primary operation	3	(20%)
3–6 months after the primary operation	11	(73%)
> 6 months after the primary operation	1	(7%)
Do you routinely remove suture-button? ($n = 77$)*		
Yes	1	(1%)
No	76	(99%)
In the setting of an unstable syndesmotic ankle injury, approximately how often do you repair the deltoid ligament? ($n = 102$)*		
Never	79	(77%)
<25% of cases	22	(22%)
26–50% of cases	1	(1%)

* *The number in parentheses represents the number of cases with information available for the given characteristic.*

current technique preference was 28%. The concordance between suture buttons being used in training and being the current technique preference was 51%. Members who were more than 15 years posttraining had 4.7 times the odds of preferring screw treatment compared to members who were less than 5 years posttraining (OR = 4.7; 95% CI, 1.14–19.34; $P = .03$). There were no significant associations detected between fellowship type and preference ($P = .39$), the number of fractures operated on in the last year, and preference ($P = .67$), or practice setting and preference ($P = .88$).

Since the start of each member's clinical practice, 62 members (60%) changed their preferred implant for pediatric syndesmotic ankle injuries with the vast majority (56/62; 90%) switching to a suture-button technique. The most frequent reasons for changing clinical practice included avoidance of secondary surgery (46/62; 74%), and extrapolation from outcomes in adults (39/62; 63%). For the 40 members who did not change their preferred implant type, 83% (33/40) did not change their management preference because of their comfort with the procedure (Table 3; Fig. 1). Of the 40 participants who reported no change in preference, 21 reported suture button as their preferred preference, 18 reported screws as their preference, and 1 participant was unknown. Of the 62 participants who said they had a change in preference, 56 reported they now prefer suture buttons, and 6 members reported they now prefer screws. Of the respondents that changed implant preference, 8 were <5 years, 16 were 5–10 years, 17 were 11–15 years, and 20 were >15 years posttraining. Of the respondents that did not change implant preference, 17 were <5 years, 9 were 5–10 years, 5 were 11–15 years, and 9 were >15 years posttraining.

Responses to the 4 case-based scenarios demonstrated strong preference for suture-button fixation over screw fixation (Figs 3, 5, 7 and 9). Of the respondents, 28% (29/102) of members picked the same treatment type for all 4 cases as skeletally immature and mature patients. Of those 29 members, 10 listed fracture pattern as something they consider when making an implant choice. For case 1 (Fig. 2), out of those who opted for surgical intervention, 76% (78/102) of respondents chose 1 or 2 suture-button fixation for a skeletally mature patient, and 77% (75/97) chose

Table 3.
Factors influencing treatment preferences ($N = 102$).

Question	Freq.	(%)
Since the start of your clinical practice, has your preferred implant for pediatric syndesmotic ankle injuries changed? ($n = 102$)*		
Yes	62	(61%)
No	40	(39%)
Factors contributing to change in management ($n = 62$)		
Avoidance of secondary surgery	46	(74%)
Extrapolation from outcomes in adults	39	(63%)
Improved biomechanics	20	(32%)
Comfort with procedure	17	(27%)
Anecdotal improved outcomes	10	(16%)
Other	3	(5%)
If there has not been a change in implant type, what factors contributed to no change in your management preference? ($n = 40$)		
Comfort with procedure	33	(83%)
Extrapolation from outcomes in adults	17	(43%)
Avoidance of secondary surgery	13	(33%)
Improved biomechanics	8	(20%)
Anecdotal improved outcomes	6	(15%)
Other	5	(13%)
What factors do you consider when choosing one implant over the other?		
Fracture pattern	52	(51%)
BMI	18	(18%)
Age	9	(9%)
Skeletal maturity	8	(8%)
Other factor not stated above	13	(13%)
No factors	34	(33%)
Do you routinely open reduce the syndesmosis when treating pediatric/adolescent syndesmotic injuries?		
Yes	8	(8%)
No	95	(92%)
Do you routinely do intra- or post-operative cross-sectional imaging to assess the adequacy of syndesmotic reduction when treating pediatric/adolescent syndesmotic injuries?		
Yes	7	(7%)
No	96	(93%)
What was the greatest challenge in effectively treating pediatric/adolescent syndesmotic ankle injuries in your practice?		
Assessing for satisfactory reduction	44	(43%)
Lack of evidence in literature to guide management	39	(38%)
Unclear indications for surgery	24	(23%)
Lack of case volume	19	(18%)
Determining initial diagnosis	18	(18%)
Cost concerns/implant availability	6	(6%)
Other challenges	1	(1%)
No challenges	15	(15%)

* *The number in parentheses represents the number of cases with information available for the given characteristic.*

the same for a skeletally immature patient (Fig. 3). For respondents choosing operative treatment for case 2 (Fig. 4), 71% (72/102) and 71% (72/102) elected for 1 or 2 suture-button technique in a skeletally mature and immature patient, respectively (Fig. 5). Similarly for case 3 (Fig. 6), 79% (79/100) and 78% (77/99) of participants opted for dynamic

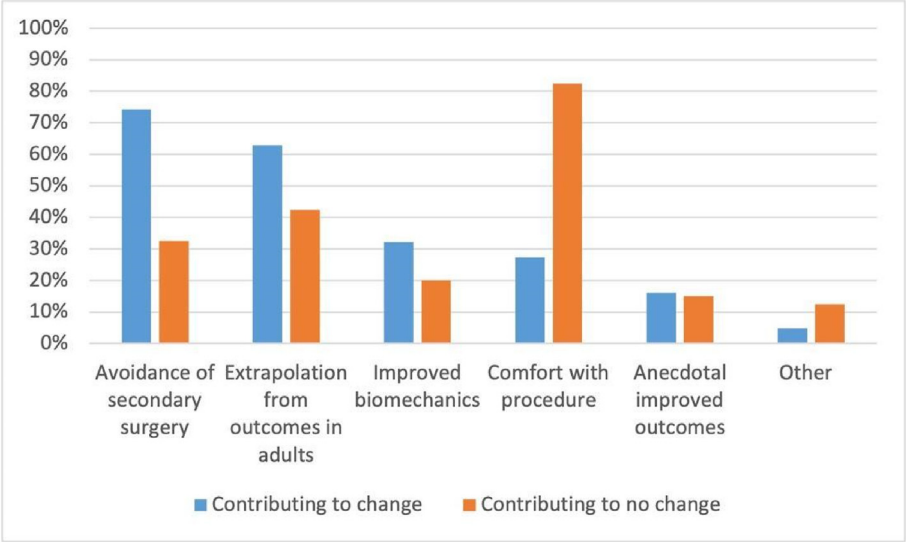

Figure 1. Bar graph of reasons for changing or not changing treatment preferences.

Figure 2. Tibia-fibula AP view and stress view of the ankle mortise under fluoroscopy of a skeletally mature adolescent male with a right ankle injury and an intact fibula. AP, anteroposterior.

fixation with 1 or 2 suture-buttons when choosing to operatively intervene in a skeletally mature and immature patient, respectively (Fig. 7). Lastly, for case 4 (Fig. 8), 78% (51/63) of respondents chose 1 or 2 suture-button technique for surgical intervention in a skeletally immature patient, and 81% (57/73) chose the same in a skeletally mature patient (Fig. 9). Of note, case 4 had a significant proportion of survey respondents opting against surgical intervention, who were excluded from the calculation of implant preference above. Respondents were queried about preferences regarding deltoid ligament repair in all of the above cases (all of which had a syndesmotic injury with medial clear space widening either at rest or with stress maneuver). The majority did not elect to repair the deltoid ligament, with only 14% ($n = 14$, case 1), 11% ($n = 11$, case 2), 1% ($n = 1$, case 3), and 20% ($n = 20$, case 4) of the survey participants answering that they would repair the deltoid ligament.

Figs 2, 4, 6 and 8. Case 1: Skeletally mature adolescent male with a right ankle injury and an intact fibula. Case 2: Skeletally mature adolescent female with a right ankle injury and a high fibula fracture. Case 3: Nearly skeletally mature (considered skeletally mature) male with a right Weber B fibula fracture. Case 4: Skeletally immature female with a widened medial clear space.

Discussion

This study aimed to document the treatment practices of pediatric orthopaedic surgeons for management of syndesmotic ankle injury in children and adolescents. According to the survey, 76% of respondents preferred suture-button fixation and 24% preferred screw fixation with

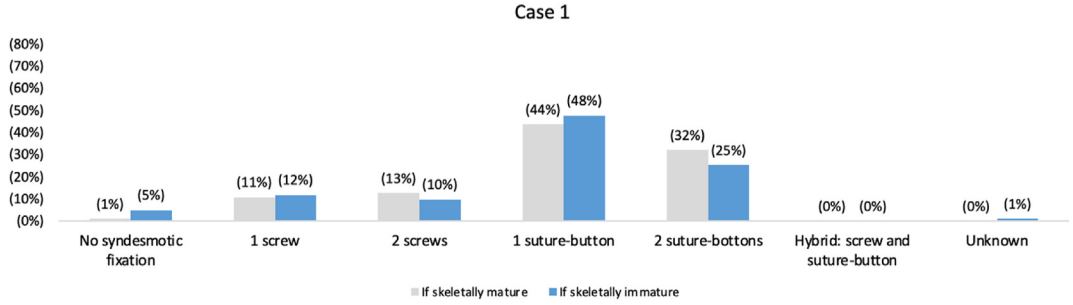

Figure 3. Bar graph of treatment preferences for syndesmotic injury of Case 1 if the patient is skeletally mature versus skeletally immature.

Figure 4. Tibia-fibula AP view and stress view of the ankle mortise under fluoroscopy of a skeletally mature adolescent female with a right ankle injury and a high fibula fracture. AP, anteroposterior.

surgeons with more years in practice more likely to opt for screw fixation. Of note, 60% of respondents reported changing implant preference during their career with over 90% switching to suture-button technique, citing avoidance of secondary surgery and extrapolation from adult outcomes as the primary motivating factors. Among those who did not choose to change, comfort with their technique was the most common reason. The preference for suture-button technique was confirmed via case-based scenarios, which reported a large majority of surgeons choosing suture-button fixation over screw fixation as the implant of choice for operative intervention.

Since the introduction of the suture-button technique in the mid-2000s, numerous studies in adults have reported superior results for suture-button fixation over screw fixation [5–13]. In a systematic review, Zhang and colleagues noted that dynamic fixation can lead to statistically significant better ankle range of motion ($P < .01$) and clinically significant earlier return to work (2.8 months vs 4.6 months, $P = .02$) compared to the syndesmotic screw technique [11]. In a recent meta-analysis of 12 clinical studies involving 320 patients in suture-button and 334 patients in syndesmotic screw groups, Xu and colleagues reiterated previous findings that dynamic fixation leads to statistically significant improvement in functional outcomes with the American Orthopaedic Foot and Ankle Society (AOFAS) scores at 3 months (mean difference 4.75, $P = .01$) and 2 years (mean difference 5.60, $P = .02$), implant removal (3.73% vs 40.30%, $P < .01$), implant failure (0% vs 20.89%, $P < .01$), local irritation (2.70% vs 11.89%, $P = .004$), and malreduction (17.48% vs 28.71%, $P = .0008$) compared to screw fixation [5].

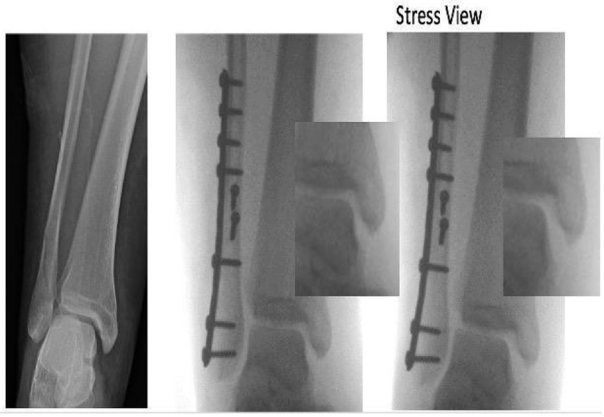

Figure 6. Tibia-fibula AP view, mortise ankle view after fibular fixation, and external rotation stress view of the ankle mortise under fluoroscopy of a nearly skeletally mature (considered skeletally mature) male with right Weber B fibula fracture. AP, anteroposterior.

However, pediatric-specific data demonstrating optimal choice of fixation method is limited with only one retrospective cohort study reporting equivalent functional outcome with lower rates of implant removal surgery in dynamic fixation [16]. Surveys of orthopaedic surgeons for treatment of adult syndesmotic injuries have documented a trend toward the use of suture-button fixation instead of screw fixation [14,15]. Through their survey, Rogero and colleagues identified factors influencing choice of preferred operative technique including years of practice, type of fellowship, number of fractures operated on per year, country of practice, and practice setting [15]. They also found that 59% had changed implant preference over their career, similar to the results in our study, and that 33% were open to changing treatment technique in the future [15]. To the authors' knowledge, this survey represents the first large-scale national survey of pediatric orthopaedic surgeons regarding treatment practices for syndesmotic injuries in pediatric and adolescent patients.

There are several limitations to this study. First, the data collected is derived from survey responses, which make them susceptible to recall bias. Case-based scenarios alleviate some of the bias by allowing respondents to not rely solely on recall. Moreover, this study does not account for the influence of external factors on choice of implant, including its availability at the provider's institution. The survey also does not identify barriers to switching treatment preferences, such as interests in and opportunities to learn alternative techniques, which may help explain the preference for screw fixation in surgeons with more years in practice. Further studies aiming to better define these barriers would be beneficial.

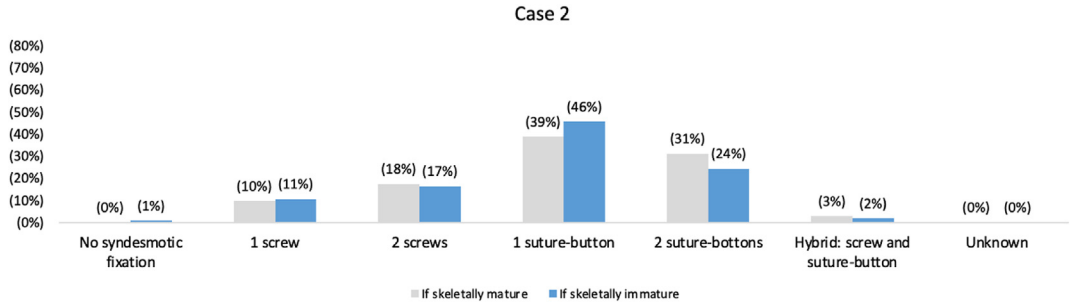

Figure 5. Bar graph of treatment preferences for syndesmotic injury of Case 2 if the patient is skeletally mature versus skeletally immature.

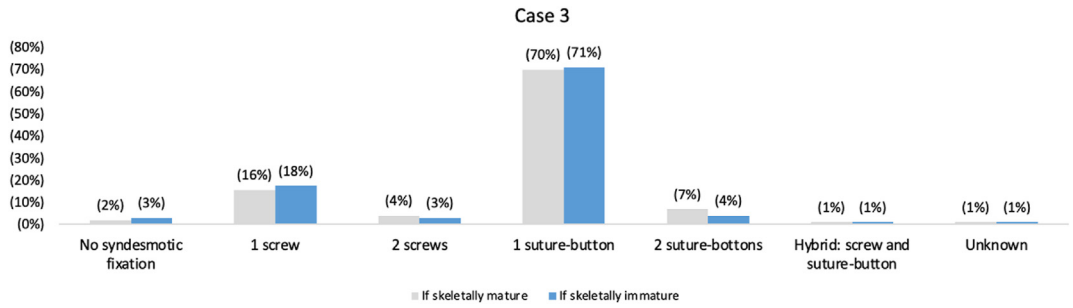

Figure 7. Bar graph of treatment preferences for syndesmotic injury of Case 3 if the patient is skeletally mature versus skeletally immature.

Figure 8. Tibia-fibula AP views of a skeletally immature female with a non-displaced medial malleolar fracture and a widened medial clear space. AP, anteroposterior.

Documenting current practices and understanding factors that influence treatment choice are key to understanding variations in management and guiding best practices. The current literature and our survey data have shown that surgeons are willing to adopt novel surgical approaches if they are supported with evidence from large, methodologically sound clinical trials [19,20]. Large-scale studies comparing outcomes between dynamic and static fixation in pediatric patients are needed in order to establish the optimal management for these injuries. If a dynamic suture-button implant is demonstrated to be superior to screw fixation for pediatric patients, then facilitating approaches to overcome the barriers to changing practice will be crucial to promote surgeons, providing the gold standard of management for these injuries.

Consent for publication

The author(s) declare that no patient consent was necessary as no images or identifying information are included in the article.

Author contributions

Caroline E. Williams: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Blair Stewig:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation. **Sang Won Lee:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation. **Danielle Cook:** Writing – review & editing, Methodology, Investigation, Formal analysis. **Benjamin J. Shore:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Conceptualization. **Collin J. May:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Investigation, Conceptualization.

Funding

None.

Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

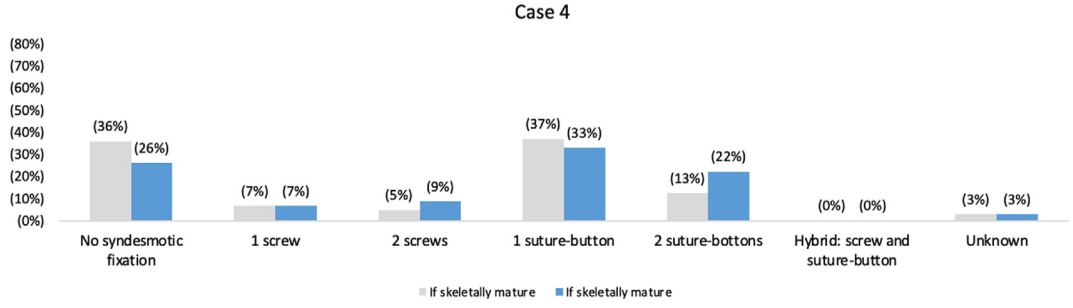

Figure 9. Bar graph of treatment preferences for syndesmotic injury of Case 4 if the patient is skeletally mature versus skeletally immature.

References

[1] Erickson JB, Samora WP, Klingele KE. Ankle injuries in the pediatric athlete. Sports Med Arthrosc Rev 2016;24:170–7. https://doi.org/10.1097/JSA.0000000000000125.

[2] Dubin JC, Comeau D, McClelland RI, Dubin RA, Ferrel E. Lateral and syndesmotic ankle sprain injuries: a narrative literature review. Journal of Chiropractic Medicine 2011;10:204–19. https://doi.org/10.1016/j.jcm.2011.02.001.

[3] Williams GN, Allen EJ. Rehabilitation of syndesmotic (high) ankle sprains. Sport Health 2010;2:460–70. https://doi.org/10.1177/1941738110384573.

[4] Thornes B, Shannon F, Guiney A-M, Hession P, Masterson E. Suture-button syndesmosis fixation: accelerated rehabilitation and improved outcomes. Clin Orthop Relat Res 2005;431:207–12. https://doi.org/10.1097/01.blo.0000151845.75230.a0.

[5] Xu K, Zhang J, Zhang P, Liang Y, Hu J-L, Wang X, et al. Comparison of suture-button versus syndesmotic screw in the treatment of distal tibiofibular syndesmosis injury: a meta-analysis. J Foot Ankle Surg 2021;60:555–66. https://doi.org/10.1053/j.jfas.2020.08.005.

[6] McKenzie AC, Hesselholt KE, Larsen MS, Schmal H. A systematic review and meta-analysis on treatment of ankle fractures with syndesmotic rupture: suture-button fixation versus cortical screw fixation. J Foot Ankle Surg 2019;58:946–53. https://doi.org/10.1053/j.jfas.2018.12.006.

[7] Xie L, Xie H, Wang J, Chen C, Zhang C, Chen H, et al. Comparison of suture button fixation and syndesmotic screw fixation in the treatment of distal tibiofibular syndesmosis injury: a systematic review and meta-analysis. Int J Surg 2018;60:120–31. https://doi.org/10.1016/j.ijsu.2018.11.007.

[8] Elabd A, Abdullah S, Kandel W, Hegazy M. Syndesmotic stabilization: syndesmotic screw versus flexible fixation: a systematic review. J Foot Ankle Surg 2021;60:998–1007. https://doi.org/10.1053/j.jfas.2020.09.021.

[9] Shimozono Y, Hurley ET, Myerson CL, Murawski CD, Kennedy JG. Suture button versus syndesmotic screw for syndesmosis injuries: a meta-analysis of randomized controlled trials. Am J Sports Med 2019;47:2764–71. https://doi.org/10.1177/0363546518804804.

[10] Onggo JR, Nambiar M, Phan K, Hickey B, Ambikaipalan A, Hau R, et al. Suture button versus syndesmosis screw constructs for acute ankle diastasis injuries: a meta-analysis and systematic review of randomised controlled trials. Foot Ankle Surg 2020;26:54–60. https://doi.org/10.1016/j.fas.2018.11.008.

[11] Zhang P, Liang Y, He J, Fang Y, Chen P, Wang J. A systematic review of suture-button versus syndesmotic screw in the treatment of distal tibiofibular syndesmosis injury. BMC Muscoskel Disord 2017;18:286. https://doi.org/10.1186/s12891-017-1645-7.

[12] Schepers T. Acute distal tibiofibular syndesmosis injury: a systematic review of suture-button versus syndesmotic screw repair. Int Orthop 2012;36:1199–206. https://doi.org/10.1007/s00264-012-1500-2.

[13] Gan K, Zhou K, Hu K, Lu L, Gu S, Shen Y. Dynamic fixation versus static fixation for distal tibiofibular syndesmosis injuries: a meta-analysis. Med Sci Mon Int Med J Exp Clin Res 2019;25:1314–22. https://doi.org/10.12659/MSM.913324.

[14] Schepers T, Van Zuuren WJ, Van Den Bekerom MPJ, Vogels LMM, Van Lieshout EMM. The management of acute distal tibio-fibular syndesmotic injuries: results of a nationwide survey. Injury 2012;43:1718–23. https://doi.org/10.1016/j.injury.2012.06.015.

[15] Rogero RG, Illical EM, Corr D, Raikin SM, Krieg J, Tsai J. Management of ankle fractures with syndesmotic disruption: a survey of orthopaedic surgeons. Foot & Ankle Orthopaedics 2020;5:247301142OS0040. https://doi.org/10.1177/247301142OS00408.

[16] Lurie BM, Paez CJ, Howitt SR, Pennock AT. Suture-button versus screw fixation in adolescent syndesmotic injuries: functional outcomes and maintenance of reduction. J Pediatr Orthop 2021;41:e427–32. https://doi.org/10.1097/BPO.0000000000001803.

[17] Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inf 2009;42:377–81. https://doi.org/10.1016/j.jbi.2008.08.010.

[18] Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: building an international community of software platform partners. J Biomed Inf 2019;95:103208. https://doi.org/10.1016/j.jbi.2019.103208.

[19] Dijkman BG, Kooistra BW, Pemberton J, Sprague S, Hanson BP, Bhandari M. Can Orthopaedic trials change practice?: a survey of 796 Orthopaedic surgeons on the possible findings of a hip fracture trial. Acta Orthop 2010;81:122–5. https://doi.org/10.3109/17453671003587093.

[20] De Sa D, Thornley P, Evaniew N, Madden K, Bhandari M, Ghert M. CHAracteristics of research studies that iNfluence practice: a GEneral survey of Canadian orthopaedic Surgeons (CHANGES): a pilot survey. SpringerPlus 2015;4:62. https://doi.org/10.1186/s40064-015-0855-4.