

Subtalar Coalitions in the Pediatric Population: Computed Tomography Parameters as a Predictive Measure for Treatment Outcome

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STATEMENT OF PURPOSE

At this time there is no definitive set of predictive values that can be used to guide treatment of subtalar joint coalitions. There have been multiple studies looking at individual factors mostly focusing on surgical outcomes. This study will help to determine if there are Computed Tomography or clinical examination measurements that can predict response to conservative treatment.

LITERATURE REVIEW

Since it was first described by Buffon in 1769, the diagnosis and management of tarsal coalitions has continued to evolve and progress as we gain more understanding of the underlying pathology. Originally thought to be a neurological disorder treatment options consisted of tendon lengthening, nerve crushing, cast immobilization, and forced manipulation. Resection of a subtalar joint coalition was first described by Badgley in 1927 (8) and further elaborated on by Pierce Scranton, MD in 1980. He determined arbitrarily that a width of less than one half of the joint surface could be a candidate for resection. If a width greater than one half of the joint surface was visualized then cast immobilization with cortisone injection into the sinus tarsi was performed; if recalcitrant to the conservative treatment the patients would then progress to a triple arthrodesis. Another indication for progressing directly to triple arthrodesis were patients with degenerative changes at the talonavicular joint. Outcomes were measured using objective measurements of talocalcaneal joint (TCJ) motion rather than a subjective patient reported outcome measure (1).

Despite the success of the resection of the coalition by Scranton in 1987, with all patients who underwent resection demonstrating good results, there is still no standardized set of factors that can be used to predict the success of treatment protocols utilized including both surgical and nonsurgical methods (2). A recent study by Mahan et al. in 2017 utilizing both retrospective and prospective data looked at the morphology of the subtalar joint as a predictor for outcomes of coalition excision. They looked at clinical outcomes of patients with standard middle facet (MF) coalitions versus posteromedial subtalar (PMST) coalitions characterized by longer sustentaculum tali and a shorter but otherwise normal MF. A questionnaire was mailed to the retrospective group and the prospective group completed the it at the 6-month, 1-year, 2-year marks. Another study reported by Mosca in 2015 reports that 30% of patients remained pain-free after 6 weeks of a below knee walking cast. It should also be stated that this study reveals that it is not clear what causes a coalition to become painful.

METHODS

Study Design

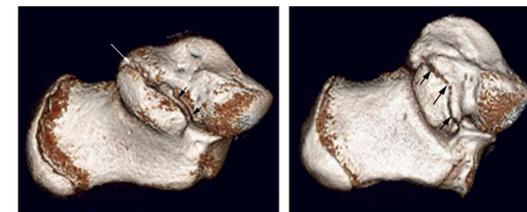
We will perform a retrospective investigation, to take place at Loyola University Medical Center in the clinic of Dr. Edwin Harris, DPM. Pediatric patients who have undergone advanced imaging for the evaluation of STJ coalitions with a minimum of six month follow up and no prior treatment interventions will be included. Baseline demographic information, procedure information, clinical characteristics and comorbidities will be obtained from the patient's electronic medical record. Inclusion criteria include patients with a documented STJ coalition with advanced imaging who are less than or equal to 18 years old. They must also have documented STJ range of motion and heel valgus. In addition, they must also have documented questioning on the presence of pedal pain prior to treatment and following treatment. Each patient was treated with UCBL orthoses manufactured by an independent laboratory.

Data Collection

A review of medical records from LUMC will be reviewed over a 10 year history (2007-2017). Those patients who had documented STJ coalitions with CT performed and a minimum of 6 month follow up. All files are saved in departmental records

Computed Tomography Values:

- Percent involvement of Middle Facet
- Posterior Medial Subtalar Coalitions vs. Standard Middle Facet
- Developmental abnormalities in Posterior Facet
- Developmental abnormalities in Talonavicular joint
- Thickness of Coalition



Three-dimensional reconstructed image of a posteromedial subtalar coalition (white arrow) from a computed tomography scan of a 12-year-old male with ankle pain demonstrating a small, but otherwise normal, middle facet (black arrows). (1)

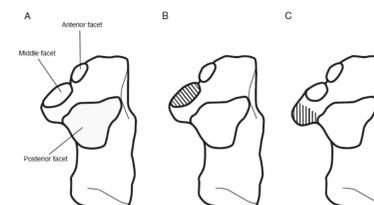
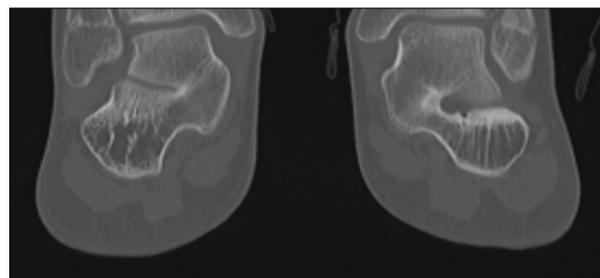


Fig. 2. Comparison of (A) normal calcaneus with (B) standard medial facet coalition and (C) posteromedial subtalar coalition. The 3 calcaneal facets are labeled on the normal calcaneus (A).

ANALYSIS/DISCUSSION



Statistical analysis was performed using a correlation coefficient analysis to determine the relationship between: STJ Inversion, STJ Eversion, Heel Valgus, Presence of TN Joint Abnormality, Percent Involvement of STJ Middle Facet, and the Thickness of the Coalition. The dependent variable of Pain was given a numerical value of 0 (no pain) and 1 (pain) present following treatment. There were zero instances of a posterior medial subtalar coalition in our study. There were also zero

Patient	STJ Inversion (degrees)	STJ Eversion (degrees)	Heel Valgus (degrees)	% Involvement	TN Joint Abnormality	Thickness of Coalition (mm)	Pain After
P1	3	3	8	48	Y	3.13	Y
P2	3	3	8	100	Y	3.91	Y
P3	10	10	4	74	N	5.00	N
P4	10	10	10	69	Y	6.86	Y
P5	15	10	6	73	N	6.39	N
P6	0	10	30	34	N	7.39	N
P7	12	5	2	95	N	3.34	Y
P8	10	5	2	100	N	6.26	Y
P9	5	10	0	50	N	5.99	N
	R= 0.01058	R= -0.7807	R= -0.2509	R= 0.6234	R= 0.6324	R= -0.4984	

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CONCLUSIONS

At this time there is not a large enough sample size to state statistical significance of the findings of this study. Degree of STJ eversion was found to have the highest predictive value ($r=0.7807$) for pain following conservative treatment with a UCBL orthotic device. A value of less than 5 degrees of eversion was trending towards a valuable predictor of pain following treatment. Another variable that had a higher level of predictability ($r=0.6324$) was the presence of a talonavicular (TN) joint abnormality. Of the three feet that had an abnormality in their TN joint present all three had pain following treatment.

Looking towards the future, needs to be further studies performed with larger sample sizes and a more uniform follow up and treatment protocol to help determine predictive value of these variables in determining success of conservative treatment of STJ coalitions.

This could serve as a valuable tool when discussing with our patients and families the options of both surgical and conservative treatments.



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