2.4mm Solid Screws vs. 4.0mm Cannulated Screws for Medial Malleolar Fixation in Unstable Ankle Fractures: No Significant Difference

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INTRODUCTION

- Ankles fractures, the 3rd most common adult fractures, represent significant cost to society[1-2]
- The ideal type of medial malleolar fixation is not known, and must balance:
  - Fixation strength
  - Implant cost[3]
  - Hardware prominence
- There is significant variability in fixation constructs for horizontal medial malleolar fractures regarding screw diameter, cannulation, and thread type

PURPOSE

- ***To compare the clinical efficacy of medial malleolar fixation with 2.4mm non-cannulated fully threaded screws to fixation with 4.0mm cannulated partially threaded screws***

MATERIALS & METHODS

- Retrospective Case-Control Study
  - Groups propensity-score matched by age, DM2, smoking status, BMI, fracture type
- 2.4mm medial screw group: 53 patients
- 4.0mm medial screw group: 60 patients
- Included: horizontally or obliquely oriented medial malleolus fractures with radiographs from immediately post-op through bony union, fixed with 1 or 2 screws, as part of unstable (bi- or tri-malleolar) ankle fracture
- Excluded: vertically oriented medial malleolus fractures, isolated medial malleolus fractures
- Patient clinic notes and radiographs reviewed
- Outcomes:
  - Loss of medial reduction or medial hardware failure
  - Medial wound complications
  - Elective removal of symptomatic medial hardware

RESULTS

Table 1: Patient Demographics by Type of Medial Screw Fixation

	2.4mm	4.0mm	All	P
N	53	60	113	
Age (yrs)Δ	48.3 (14.4)	52.4 (13.2)	50.5 (13.9)	0.116
BMI	29.9 (6.4)	27.6 (5.4)	28.7 (6.0)	0.043
CCI	0.60 (SD 1.5)	0.47 (SD 1.1)	0.53 (SD 1.3)	0.587
DM Δ	5 (8.8%)	7 (11.7%)	12 (10.3%)	0.763
Smoking Δ				0.984
Never	29 (50.9%)	31 (51.7%)	60 (51.3%)	
Former	11 (19.3%)	12 (20.0%)	23 (19.7%)	
Current	17 (29.8%)	17 (28.3%)	34 (29.1%)	
Assisted Ambulation	3 (5.0%)	2 (3.4%)	5 (4.3%)	0.677
Concurrent Injuries	16 (28.1%)	2 (3.3%)	18 (15.4%)	<0.001
Discharge to Facility	8 (14.0%)	0	8 (6.8%)	0.002

Δ=category included in propensity score matching *CCI=Charleston Comorbidity Index (not age adjusted); BMI=Body Mass Index; DM=Diabetes Mellitus

Table 2: Fracture Classification by Type of Medial Screw Fixation

		2.4mm	4.0mm		P
OTA	*44A2*	0	2 (3.3%)	2 (1.8%)	0.19
	44A3	0	1 (1.7%)	1 (0.9%)	
	44B2	12 (22.6%)	18 (30.0%)	30 (26.5%)	
	44B3	28 (52.8%)	31 (51.7%)	59 (52.2%)	
	44C1	3 (5.7%)	2 (3.3%)	5 (4.4%)	
	44C2	10 (18.9%)	4 (6.7%)	14 (12.4%)	
	44C3	0	2 (3.3%)	2 (1.8%)	
Weber	*A*	0	3 (5.0%)	3 (2.7%)	0.129
	B	41 (77.4%)	49 (81.7%)	90 (79.6%)	
	C	12 (22.6%)	8 (13.3%)	20 (17.7%)	
Malleoli	*Bimalleolar*	11 (20.8%)	21 (35.0%)	32 (28.3%)	0.100
	Trimalleolar	42 (79.2%)	39 (65.0%)	81 (71.7%)	

Table 3: Ankle Fixation Construct by Type of Medial Screw Fixation

	2.4mm	4.0mm	All	P
Posterior Fixation	15 (28.3%)	17 (28.3%	32 (28.3%)	1
Syndesmosis Fixation	35 (66.0%)	18 (30.0%)	53 (46.9%)	<0.001
Lateral Fixation				<0.001
1/3 Tubular Plate	18 (34.0%)	21 (35.6%)	39 (34.5%)	
Precontoured plate	30 (56.7%)	13 (22.0%)	43 (38.0%)	
Locking plate	0	22 (37.3%)	22 (19.5%)	
Other	5 (9.4%)	3 (5.1%)	8 (7.1%)	
# Medial Screws				0.86
1	4 (7.5%)	4 (6.7%)	8 (7.1%)	
2	49 (92.4%)	56 (93.3%)	92.9%)	

RESULTS

Table 4: Complications by Type of Medial Fixation

	2.4mm	4.0mm	All	P
General				
*All Complications**	4 (7.5%)	8 (13.3%)	12 (10.6%)	0.32
Non-Operative	1 (1.9%)	6 (10.0%)	7 (6.2%)	0.74
*Operative**	3 (5.7%)	3 (5.0%)	6 (5.3%)	0.88
Elective ROHΔ	4 (7.5%)	5 (8.3%)	9 (8.0%)	0.88
Medial-Sided				
Loss of Reduction	1 (1.9%)	2 (3.3%)	3 (2.6%)	0.63
Hardware Breakage	1 (1.8%)	0	1 (0.9%)	0.47
Hardware Removal	1 (1.9%)	3 (5.0%)	4 (3.5%)	0.62
Wound Complications	0	2 (3.3%)	2 (1.8%)	0.5

*excluding elective removal of hardware ΔROH= removal of hardware

DISCUSSION

- No significant difference in complications between 2.4mm non-cannulated fully threaded and 4.0mm cannulated partially threaded screws regarding:
  - medial loss of reduction
  - Medial implant breakage
  - Medial wound complications
  - Medial hardware prominence
- Given their decreased cost and equivalent ease of insertion, surgeons should consider using 2.4mm non-cannulated screws when fixing transverse medial malleolus fractures.
- Further study is needed on the clinical outcomes and cost of varied ankle fixation constructs

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