

Determination of Inter- and Intra-Rater Reliability of Fusion Assessment in 1st TMT Joint Arthrodesis



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Statement of Purpose

- Primary:** Determine the reliability amongst both orthopedic surgeons and radiologists in reviewing postoperative radiographs and CT scans in order to determine fusion in patients undergoing 1st TMT arthrodesis
- Secondary:** To determine if CT scan offers improved inter- and intra-rater reliability when compared to plain radiographs

Methodology and Procedures

- Retrospective review** of patients undergoing midfoot arthrodesis from 2011-2016
- Demographic and comorbidity variables collected for each patient
- Patients must have had **postoperative CT scans and plain radiographs**
- Three raters (two orthopedic surgeons, one radiologist)** reviewed CT scans and radiographs in a randomized pattern to determine fusion
- Repeat review of the same CT scans and radiographs** by the same raters 6 months later
- Statistics: **Krippendorff's alpha coefficient** was calculated to determine the inter- and intra-rater reliability for 1st TMT joint fusion

Literature Review

- Midfoot fusion** procedures can be performed for multiple pathologies including: osteoarthritis, trauma, ligamentous lisfranc injuries, hallux valgus deformity¹⁻³
- Fusion rate** for midfoot procedures reported to be between **2-12%**⁴⁻⁸
- CT scan use for fusion determination is increasing, but **artifact and metallic scatter** can hinder fusion determination

Table 1. Patient Demographics

	N=24
Age (Mean ± SD)	53.8 ± 2.3
Sex (n)	
Female	75% (16)
Male	25% (8)
BMI (Mean ± SD)	30.0 ± 1.3
CCI (Mean ± SD)	1.5 ± 0.3
CCI 10 Year Mortality (% , Mean ± SD)	87.9 ± 43
Procedure Type (n)	
1 st TMT Fusion	29.2% (7)
Lapidus	12.5% (3)
Lapidus + 1 st -2 nd MT fusion	54.2% (13)
Midfoot + 1 st -2 nd TMT fusion	4.2% (1)
Operative Side	
Left	54.2% (13)
Right	45.8% (11)

BMI = Body Mass Index; CCI = Charlson Comorbidity Index; SD = Standard deviation; TMT = tarsal-metatarsal; MT = metatarsal

Table 2. Inter-rater reliability (Fusion 0-50%, 50-100%)*

	n	Percent Agreement	Krippendorff's Alpha
X-RAY			
Joint 1 Time 1	24	0.46	0.29
Joint 1 Time 2	24	0.42	0.15
CT			
Joint 1 Time 1	24	0.71	0.61
Joint 1 Time 2	24	0.75	0.65

*Joint 1 = 1st TMTJ
*Time 1 = Initial reading; Time 2 = 6 month

Table 3. Inter-rater reliability (Fusion 0-25%, 25-100%)*

	n	Percent Agreement	Krippendorff's Alpha
X-RAY			
Joint 1 Time 1	24	0.71	0.31
Joint 1 Time 2	24	0.24	0.17
CT			
Joint 1 Time 1	24	0.71	0.42
Joint 1 Time 2	24	0.63	0.39

*Joint 1 = 1st TMTJ
*Time 1 = Initial reading; Time 2 = 6 month



Results

- 24** 1st TMT joint arthrodeses included
- At a **fusion threshold of 50%**, initial and 6-month interrater reliability for **plain radiographs** was $\alpha = 0.29$ and $\alpha = 0.15$
- At a **fusion threshold of 50%**, initial and 6-month interrater reliability for **CT scan** was $\alpha = 0.61$ and $\alpha = 0.65$
- At a **fusion threshold of 25%**, initial and 6-month interrater reliability for plain radiographs was $\alpha = 0.31$ and $\alpha = 0.17$
- At a **fusion threshold of 25%**, initial and 6-month interrater reliability for **CT scan** was $\alpha = 0.42$ and $\alpha = 0.59$
- Neither modality** reached the criteria for reliable data (Krippendorff's alpha ≥ 0.80)

Discussion

- CT scan provides better reliability for fusion assessment** when compared to plain radiographs at multiple fusion thresholds
- However, **neither modality meets the criteria for consistently reliable assessment**
- Practitioners must make difficult management decisions without definitive evidence of fusion
- Practitioners must determine if the **increased radiation exposure and cost of CT** is worth the marginal improvement in fusion determination

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