Lower Limb Surface Pressures Generated by Different Casts

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Clinical Setting

• Casts
  • Common
  • Complete/split/backslab
  • Backslabs often 1\textsuperscript{st}-line
Clinical Setting

• **Casts**
  - Common
  - Complete/split/backslab
  - Backslabs often 1\textsuperscript{st}-line

• **Problems**
  - Swelling + pain
  - Compartment syndrome
  - Skin necrosis
Clinical Setting

• **Pressure rise** once casts applied\(^1\)

• **Unknown swelling response** of different cast materials + configurations

• Experience – backslabs cause pain

\(^1\)Moir et al. 1991  JBJS
Background

- **Forearm** POP backslab vs split POP\(^1\)
  - Split casts accommodate swelling better

- Splitting casts – reduces intramuscular pressures
  - 65% animal study\(^2\)
  - Bivalving casts: 33-47% in calf\(^3\)

- Intracompartmental pressure ≈ skin **surface pressure** under cast\(^4\)

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\(^1\) Younger et al. 1990 Injury  \(^2\) Garfin et al. 1981 JBJS  \(^3\) Weiner et al. 1994 JBJS  
\(^4\) Uslu et al. 2000 Arch Orth + Tr Surg
AIMS

Is there an effect of

1. Complete vs. Split vs. Backslab
2. Cast material

Hypothesis:

● Backslabs generate higher surface contact pressures due to smaller surface area
Measuring intracast pressures
Methodology
Methodology
Methodology:
Different cast types:

1. Complete fiberglass
2. Complete POP
3. Split complete fiberglass
4. Split complete POP
5. Backslab POP
Methodology:

Measuring Pain

Pain was assessed using the Visual Analog Scale
RESULTS:
SURFACE PRESSURES

Surface Pressures Generated By Different Casts

- Backslab
- Complete POP
- Split POP
- Complete Fiberglass
- Split Fiberglass

Manometer Pressure (mmHg) vs. Surface Pressure (mmHg)
RESULTS:
SURFACE PRESSURES

Surface Pressures Generated By Different Casts

Complete fiberglass -> complete POP/backslabs p=0.018/0.008
RESULTS:
SURFACE PRESSURES

Surface Pressures Generated By Different Casts

- Backslab
- Complete POP
- Split POP
- Complete Fiberglass
- Split Fiberglass

Split fiberglass/POP *reduced pressures >50mmHg
RESULTS:
SURFACE PRESSURES

Surface Pressures Generated By Different Casts

- Backslab
- Complete POP
- Split POP
- Complete Fiberglass
- Split Fiberglass

**Backslab >* pressure than split POP >100mmHg p=0.003**
RESULTS:
PAIN

Pain Levels Generated By Different Casts

![Graph showing pain levels generated by different casts.](image-url)
RESULTS: PAIN

Pain Levels Generated By Different Casts

Fiberglass *highest pain >75mmHg (p=0.001)
RESULTS: PAIN

Pain Levels Generated By Different Casts

Split fiberglass *reduced pain (p=0.001)
Split POP did not reduce pain at low pressures (<150 mmHg)
Conclusion

**Fiberglass casts** generate greatest surface pressures + pain at higher pressures

- greater recoil at splitting site?
Conclusion

Fiberglass casts generate greatest surface pressures + pain at higher pressures
• greater recoil at splitting site?

Split casts significantly reduced pressures
• but still caused pain
Conclusion

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  • greater recoil at splitting site?

Split casts significantly reduced pressures
  • but still caused pain

Split POP LOWER surface pressure than backslabs
Limitations

Surrogate Model - healthy subject + saline system

Cannot validate correlation surface vs intracompartamental pressures

No modeling of delayed swelling
Study Recommendations

Apply split POP when swelling anticipated
• Low surface pressure + pain
• Better fracture stability?

Consider splitting fiberglass casts initially
THANK YOU

Funding body: British Trauma Society