

Radio-opacity test for cast materials

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Abstract The radio-opacities of WOODCAST, Plaster-of-Paris (POP) and Fiberglass casts were analysed in this study. POP cast is highly radio-opaque, whereas WOODCAST and Fiberglass are both radiolucent. Due to the radio-opacity of POP and the interfering mesh-pattern of Fiberglass reliable X-ray evaluations cannot be guaranteed without removing the cast when using these materials. However, WOODCAST material enables x-ray imaging through the cast due to low interference.

MATERIALS AND METHOD

The radio-opacity test was utilized to investigate and compare the performance of WOODCAST, POP and Fiberglass casts in X-ray images. Short-arm casts were manufactured for scaphoideum fracture from each test material. The appropriate amount of each material was wrapped circumferentially in

order to obtain reliable immobilization of the injured wrist.

The ready casts were removed from the arm and X-ray images acquired with a standard X-ray imaging machine with radiation setting: 40 kV x 65 mAs in PetVet veterinary clinics, Turku, Finland. A photo of the X-rayed casts is seen in Figure 1. Details of the test casts are given in Table 1. The black and white colour temperatures from the resultant X-ray images were measured using image software *XnView* 1.97. For each cast ten parallel measurements were performed and the average and standard deviations were calculated from those results.

The interference of cast material was evaluated using the x-ray images from the wrist casts made with POP, Fiberglass and WOODCAST.

Table 1. Details of scaphoideum casts: POP, Fiberglass and WOODCAST.

| Material | Manufacturer | Weight | Average thickness | Max number of layers | Amount of materials used |
|------------|--------------|--------|-------------------|----------------------|---|
| POP | BSN Medical | 493 g | 8 mm | >10 | 2 rolls of (5 cm) Cellona® |
| Fiberglass | 3M | 183 g | 5 mm | 2 + 3 soft | 1 roll Scotchcast™ (5 cm) + 1 roll Soft Cast (5 cm) |
| WOODCAST | Onbone Oy | 179 g | 6 mm | 1 + 3 ribbon | 10 x 40 cm sheet of 2 mm splint + 1.5 m WOODCAST Ribbon |



Figure 1. POP, Fiberglass and WOODCAST casts.

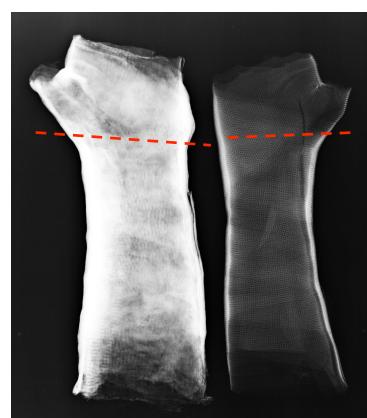


Figure 2. X-ray image of POP and Fiberglass casts.



Figure 3. X-ray image of WOODCAST and POP casts.

Table 2. Measured black and white colour temperatures.

| Material | POP | Fiberglass | WOODCAST |
|------------|------------|-------------|-------------|
| B/W value | 208 ± 6 | 81 ± 10 | 74 ± 10 |
| Assessment | radiopaque | radiolucent | radiolucent |

Explanation. 255 = black = total block for X-ray, 0 = white = fully translucent to X-rays.

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Figure 4 X-ray image of wrist with no cast.



Figure 5 X-ray image of WOODCAST.

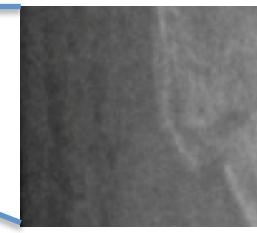


Figure 6 Enlargement from Figure 5.



Figure 7 X-ray image of POP.



Figure 8 X-ray image of Fiberglass.



Figure 9 Enlargement from Figure 8.

RESULTS AND DISCUSSION

In Figures 2 and 3 the X-ray images of scaphoideum casts are shown. The analysis lines are shown in the figures as red dotted lines. The X-ray Colour (black and white) temperatures measured from the X-ray images show that casts made of Fiberglass and WOODCAST materials are penetrated well by the given dose of X-rays (Table 2). These casts are radio-translucent, whereas POP is highly radio-opaque. The Scaphoideum cast made of WOODCAST material is even slightly more radio-transparent than cast made of Fiberglass material.

The x-ray images of wrists with no cast or with POP, Fiberglass and WOODCAST are shown in Figures 4-9. As shown in Figures 5 and 6 the WOODCAST material does not interfere with X-ray images and details of the fracture line can be evaluated without removing the cast. However, the interference of

Fiberglass and POP in X-ray images is far more disturbing.

SUMMARY

WOODCAST and Fiberglass are both radiolucent whereas POP cast is highly radio-opaque. WOODCAST material enables reliable evaluation of X-ray images without removing the cast, as the material does not interfere with the image. The radio-opacity of POP and the mesh-pattern of Fiberglass do interfere with the x-ray images and reliable X-ray evaluations cannot be guaranteed without removing the cast in these cases.

REFERENCE:

Lindfors NC and Salo J. A Novel Nontoxic WOOD-Plastic Composite Cast *The Open Medical Devices Journal*, 2012;Vol 4:1-5.