Image-guided surgical techniques for cartilage repair – an animal trial

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Purpose

Question:

Can computer guidance improve outcomes in mosaic arthroplasty?

CAMA = Computer Assisted Mosaic Arthroplasty
Three surgical methods

We compared three methods of mosaic arthroplasty:

- Image guided method
- Template guided method
- Conventional method
Computer planning for CAMA

1. Scan with CT arthrogram.

2. Build 3D model of bone and cartilage from the CT arthrogram.

3. Use software to position a mosaic of virtual plugs over the defect.

4. Find matching plug harvest sites.
Computer planning for CAMA

Planning software

Plug geometry
Computer planning for CAMA

The final plan
Image-guided CAMA

Tracker on the femur

Tracker on the tool
Image-guided CAMA

Optical tracker
Guidance display
Template-guided CAMA

From the surgical plan ... ... to the guidance template.
Separate templates are used for harvesting, drilling, and delivery.
Animal Study

15 sheep randomized into three groups: conventional, image-guided, and template-guided

At 0 months:
  Take a CT arthrogram of the original knees.
  Create a defect on each knee.

At 3 months:
  Take a pre-op CT arthrogram.
  Plan surgery (image- and template-guided).
  Perform surgery.

At 7 months:
  Harvest and evaluate the knees.
Results

RMS error in surface shape after healing compared to original surface

No significant differences were found.
Results

Treatment effect on femoral condyle (as difference in ICRS II\* histology score compared to control knee)

CAMA is better than conventional (p < 0.017).

* Mainil-Varlet et al., AJSM 2010:38
Results

Treatment effect on tibial plateau

Template-guided is better than conventional (p = 0.032).
Results

Treatment effect worsens as the percentage of **proud** plugs increases.

No correlation was found with **recessed** plugs.
Computer-assisted mosaic arthroplasty (CAMA) can improve clinical outcomes over the conventional technique.
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