A Nondestructive Autograft Extraction Method for Autologous Osteochondral Transplantation

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Disclosure

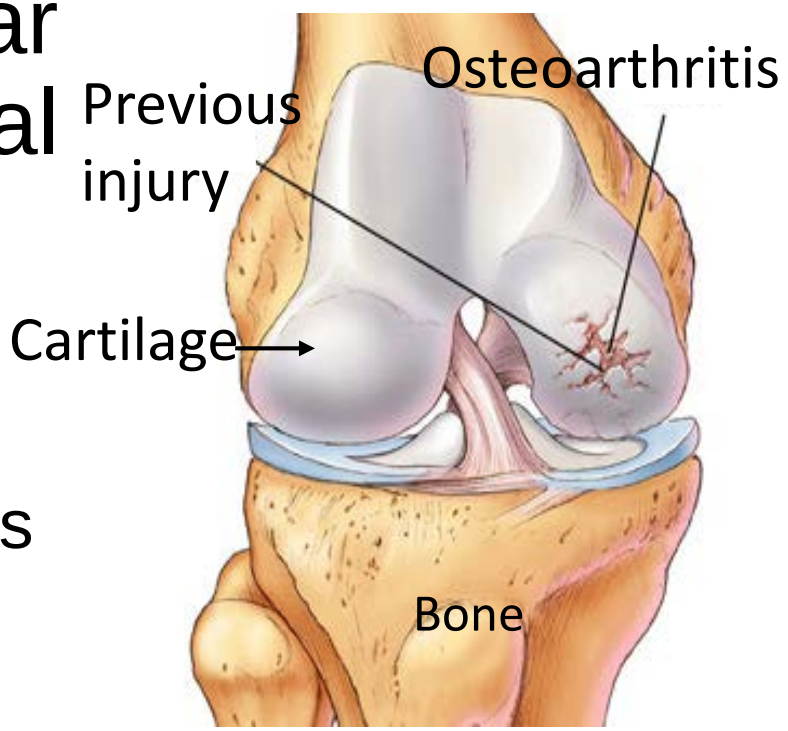
- We have no actual or potential conflict of interest in relation to this conference.

Content

- Osteoarthritis
- Current treatment
- Solution and design
- Conclusion
- Future work

Osteoarthritis

- Degeneration of articular cartilage and subchondral bone
  - Primary Osteoarthritis
  - Secondary Osteoarthritis
    - Post Traumatic Osteoarthritis
      - 5.6 Million people effected



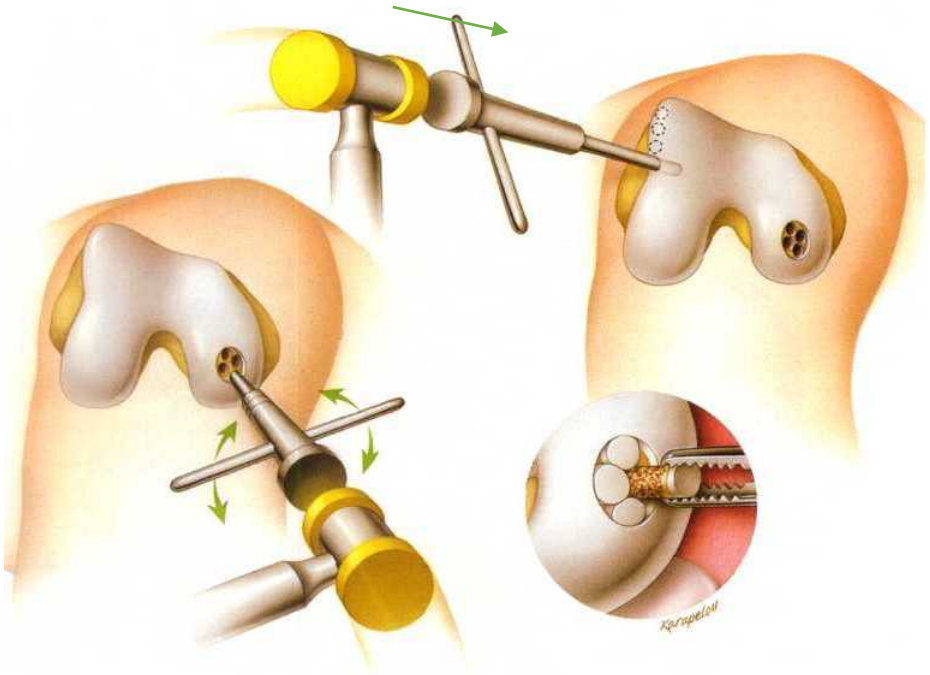
Anatomy of a knee [1]

[1] https://rockstartriathlete.com/knee-arthritis-part-two-pain-by-john-post-md

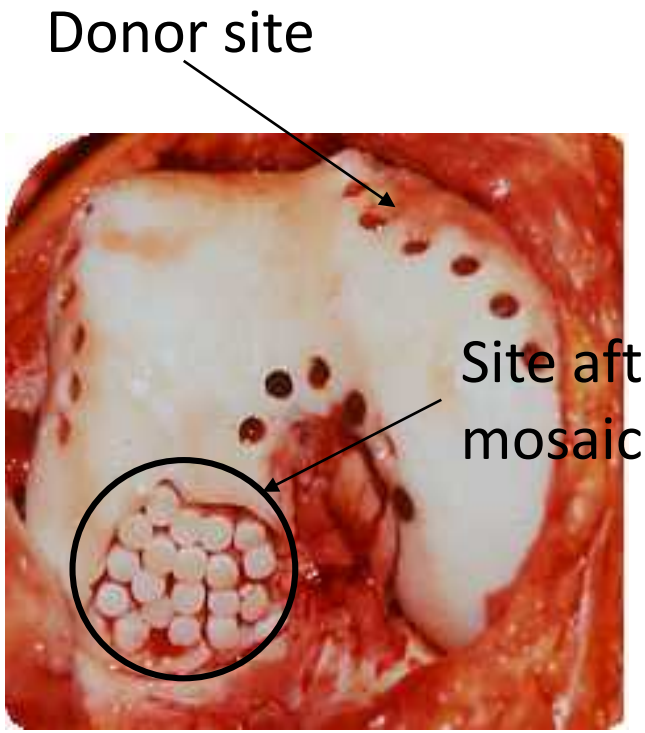
Current treatment

- General medication and weight loss
- Surgical Methods
  - Microfracture
  - Autologous chondrocyte implantation (ACI)
  - Autografting
    - Mosaicplasty
  - Allografting

Mosaicplasty (Autografting)



Mosaicplasty procedure[3]

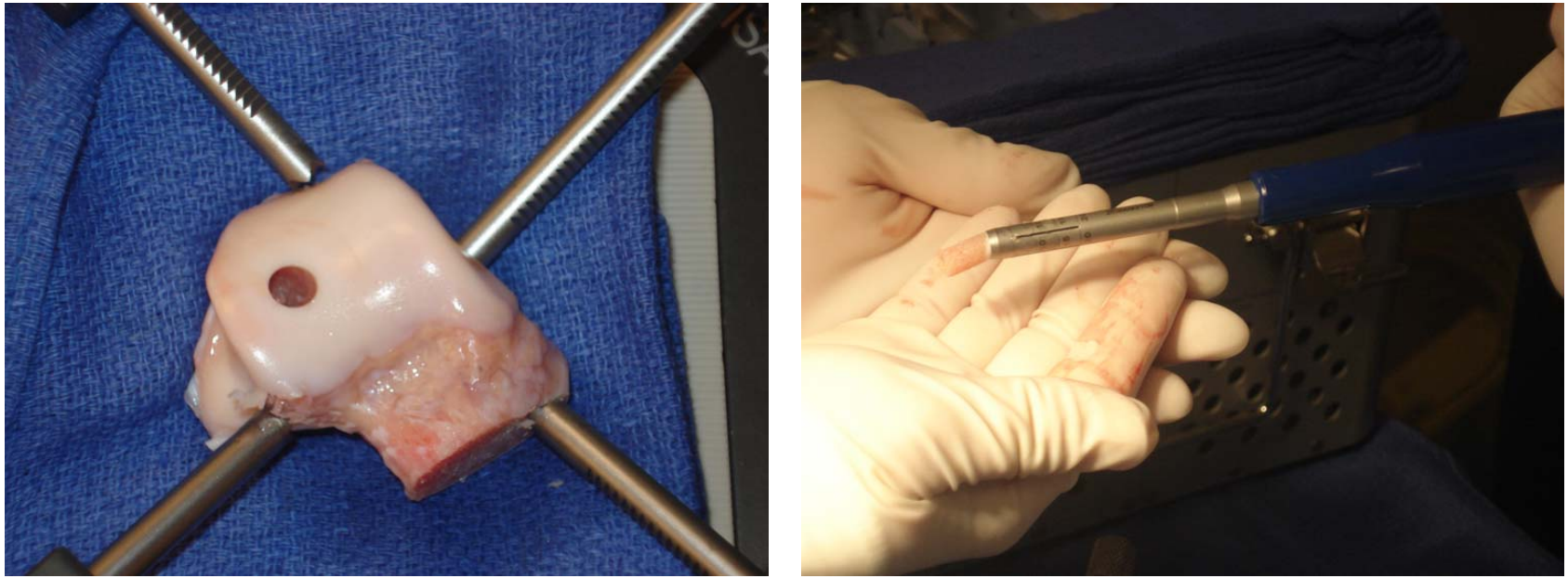


Donor and receiving site after mosaicplasty[3]

- Have to harness multiple cylindrical shaped grafts.

[3]http://www.rhumatologie-bichat.com/versier02.htm

Allografting

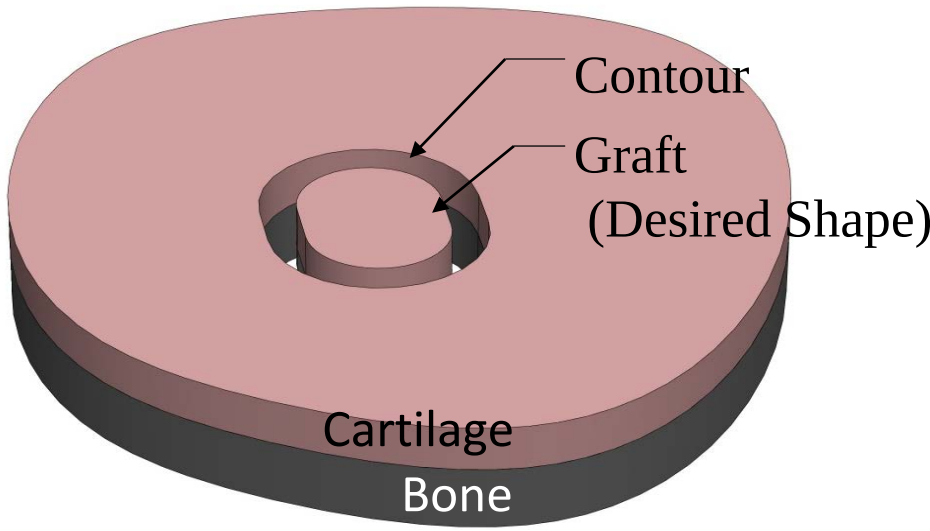


Graft extraction from a cadaver [2]

- But prone to disease transmission

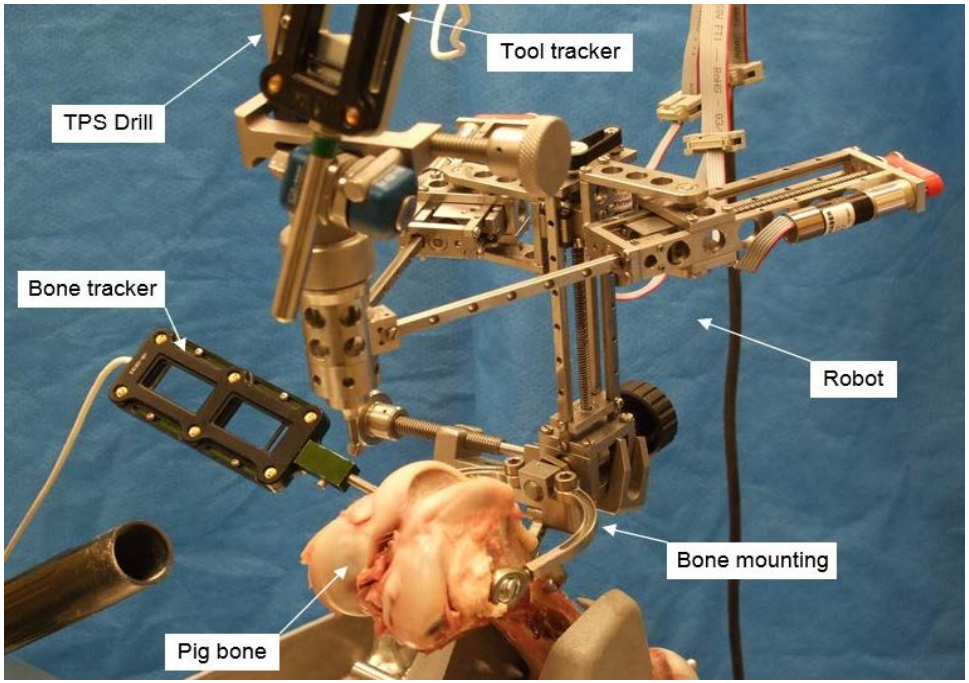
Solution: A single graft

- Detect the shape of the target area
- Mill the target/worn out area
- Choose a donor site
- Harness the graft
  - Slice off the graft's bottom

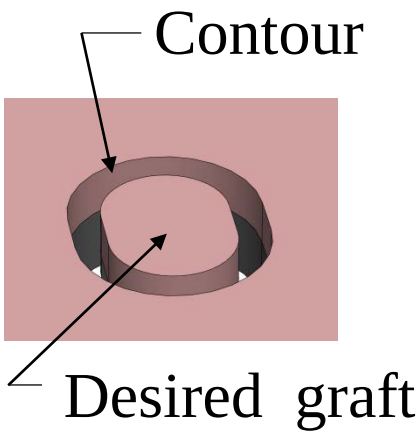


Donor site

Milling and contouring



HyBAR robot built for precise bone milling [4]



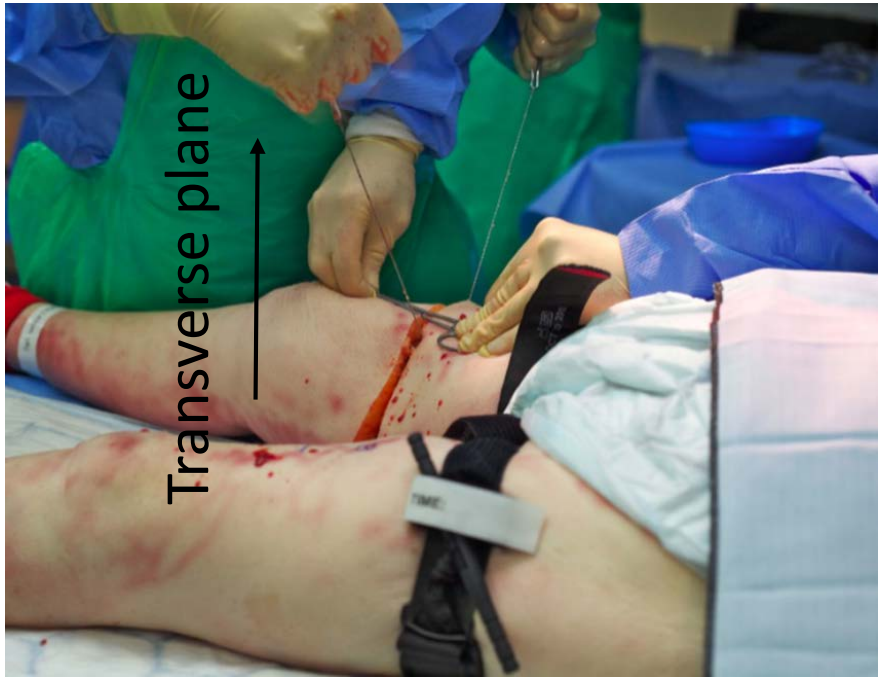
Contour creation

- Possible to mill the worn site
- Create a contour around the donor site

[4] S. Song et al. 2009

UCF

Amputation and Gigli Saw



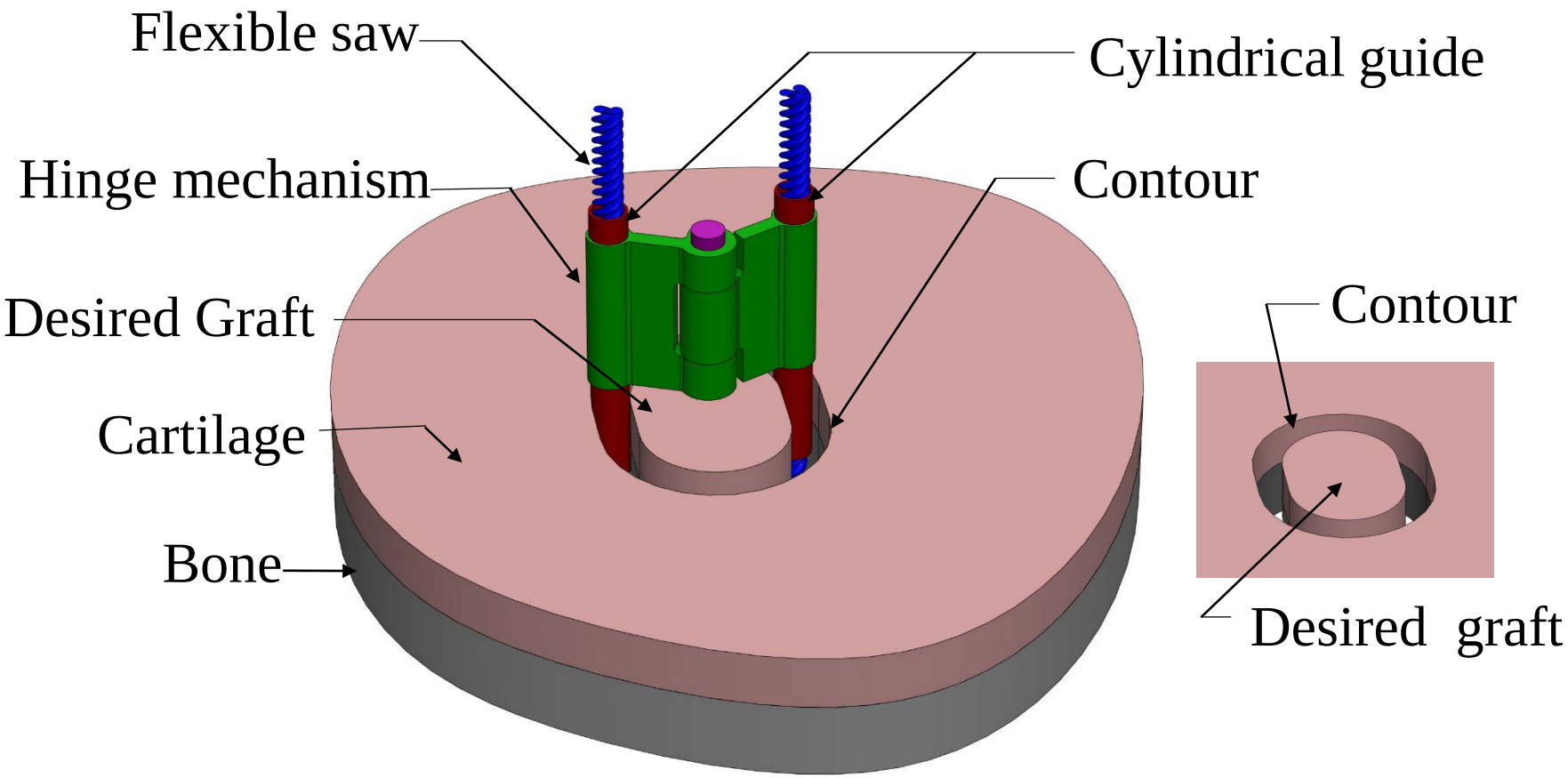
Amputation with a Gigli saw [3]

Gigli Saw used in orthopedics

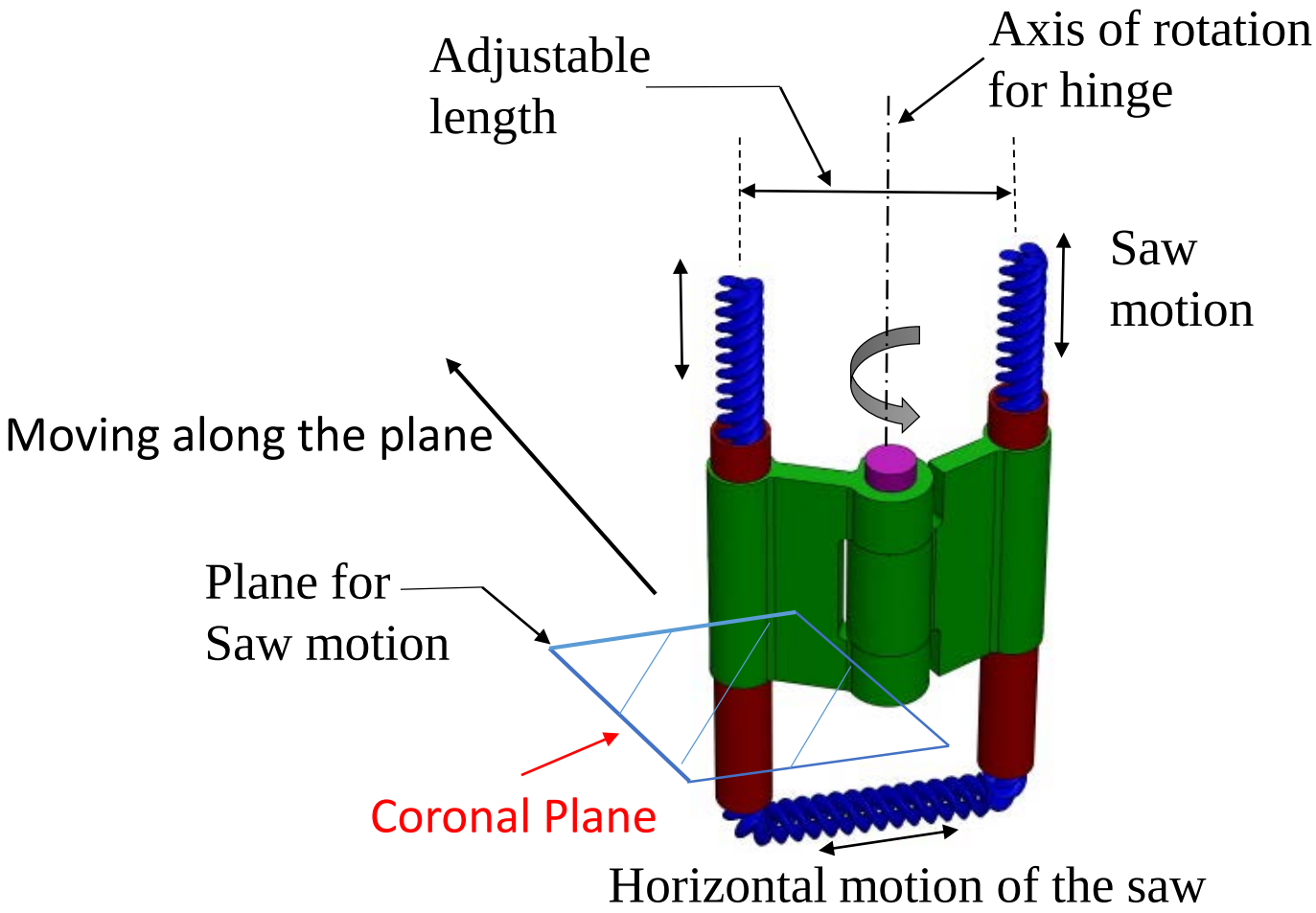
- What if we can convert the transverse motion into a motion along the coronal plane?

[3] C. Leech et al. , 2016

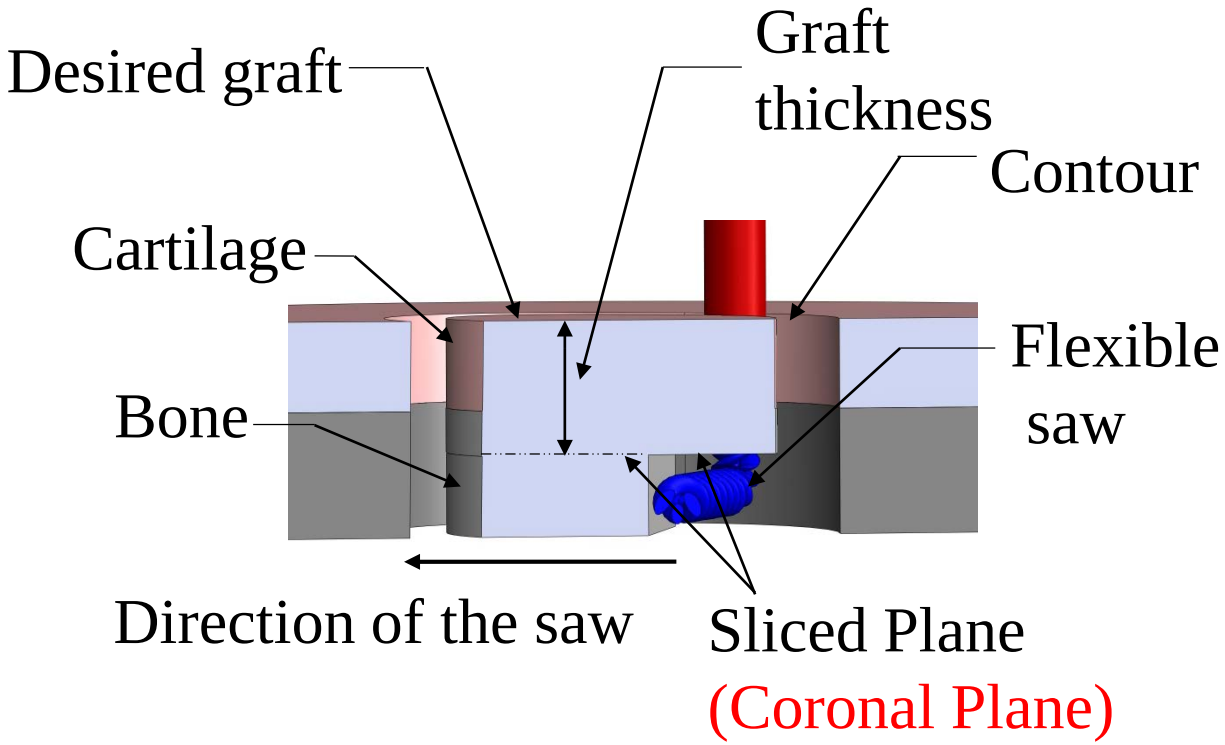
Our approach

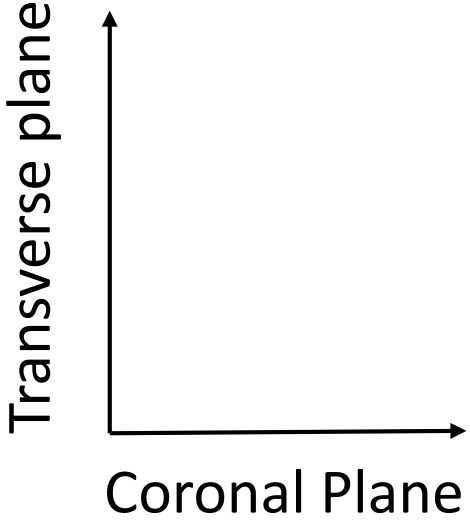


Our approach (contd.)



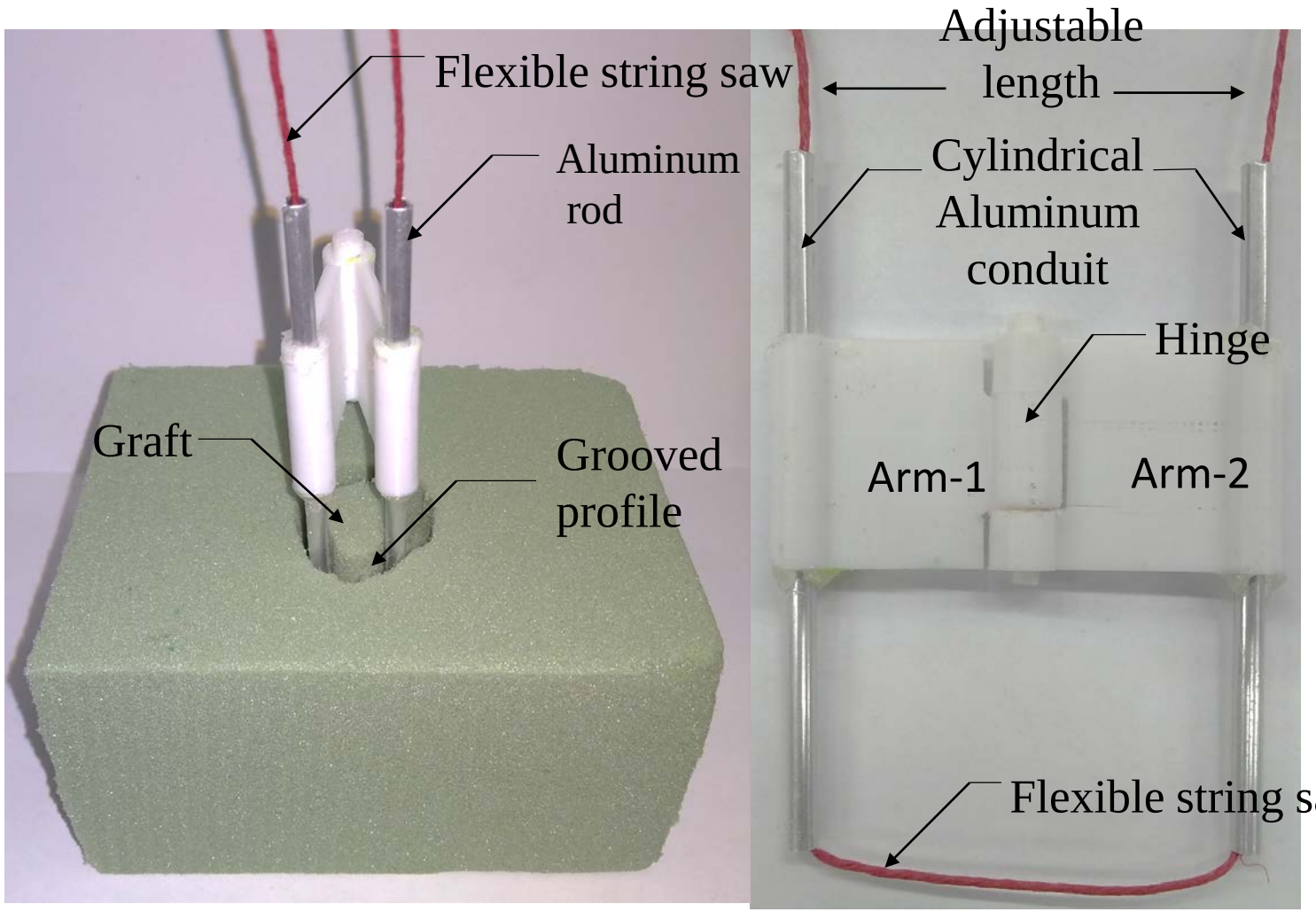
Our approach (contd.)





Cross sectional view

Prototype



Built protype

Conclusion

- Transfers transvers saw motion to the coronal plane
- Slices the desired thickness
- Deals with irregular shape due to the hinge mechanism

Future work

- Development of highly flexible string saw
- Optimize the roughness of the string
- Development of a powered saw and integration with an orthopedic robot to remove damaged area and to profile autograft

Q&A, Comments?

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