Modelling and characterization of salivary calculi

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Motivation

Sialoliths?

- Medical condition: Sialolithiasis

- Lithotripsy with low success rate
Motivation

Personalized medicine: Sialoliths mechanical modelling
Mechanical behaviour

Nanoindentation

Dry composite - Bimodal distribution with in-between $H$ and $E$ values in relation to the "purely" organic and mineralized regions
Mechanical behaviour

Microindentation

- Composite material
  Single mode distribution at microscale
Mechanical behaviour

Microindentation

- **Hidratation state**
  Drying strengthens the organic matter, without affecting the mechanical
Mechanical behaviour

Microindentation

- Dry sialoliths’ H and E are within the mechanical properties of the most organic renal calculi.
- The organic fraction enhances toughness of both renal calculi and sialoliths.
Mechanical behaviour

Fracture: Fracture patterns (Macroindentions)

- Crack progression depends on the underlying ultrastructure and mineralization degree
Lithotripsy damage

Mechanical lithotripsy

- Extensive damage
- Leaching of the organic components, the mineral components were left relatively unaffected
Final remarks

Sialoliths mechanical characterization

• Composite material at microscale: ductile / brittle phases

• Hydration state of sialoliths must be considered during the mechanical characterization

• Fracture dependent on the underlying ultrastructure and mineralization degree

• Shock waves damage: leaching of organic matrix presumably by cavitation

Thank you for your attention