

Medical Core · Verified Research

Mandibular Fracture Reduction Optimization

Convert an ambiguous clinical problem into a testable 3D registration and optimization problem.

Period 2021.12 - 2023.02 | Evidence state Verified · Completed | Portfolio tier Medical Core

Built a surgical-planning simulator and experiment pipeline that optimizes mandibular fragment pose using dental features and fracture surfaces.

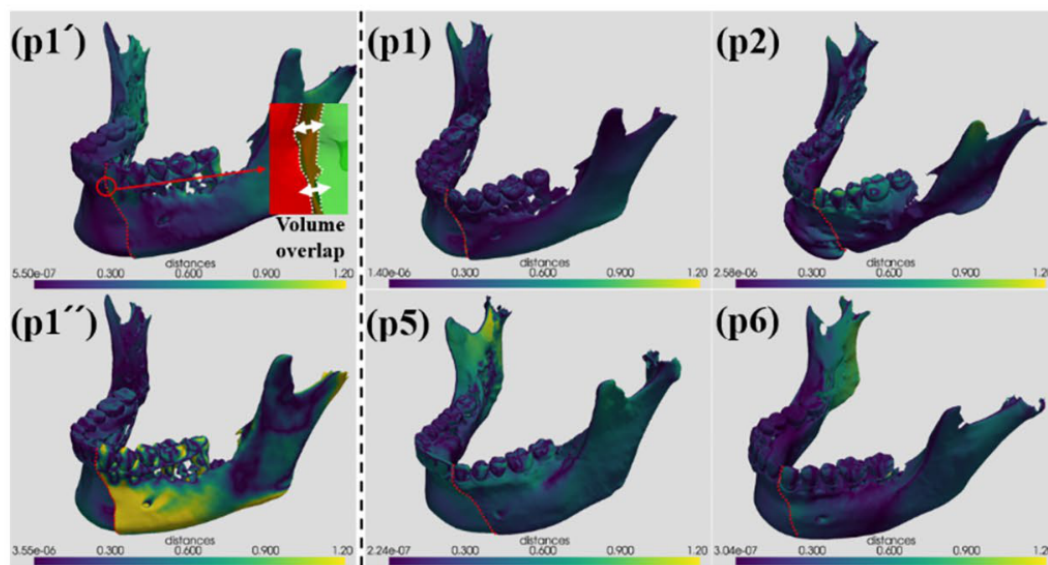


Figure 1. Surface-distance maps between the pre-fracture mandible and the reduction model (part of Fig. 3 in the published paper).

Problem and system boundary

Many geometrically plausible reductions existed; the planning target needed a reproducible constraint grounded in occlusion.

Owned decisions and implementation

My role

Jointly led the research pipeline across problem definition, feature and optimization design, simulator, experiments and analysis, and paper, serving as a co-first author.

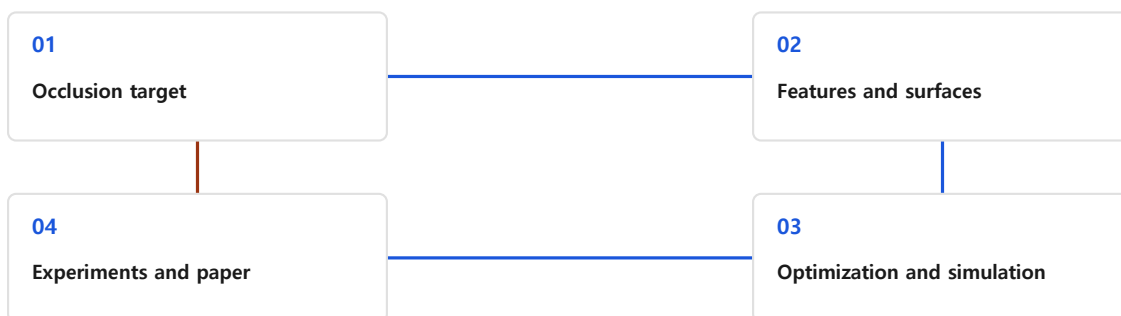
Problem definition

Defined occlusion as a reproducible target for fracture reduction.

Research pipeline

- Feature design
- Optimization
- Simulator
- Experiments and analysis
- Paper

Occlusion-constrained optimization loop



Explanatory system relationship diagram; it is not photographic or experimental evidence.

Verification and evidence ledger

ACCAS 2022, a 2022 domestic conference, a 2023 best-paper award, a 2024 Q1 SCIE peer-reviewed paper, and quantitative experiments provide the evidence.

Published evidence

Separate presentations, award, quantitative experiments, and the peer-reviewed publication.

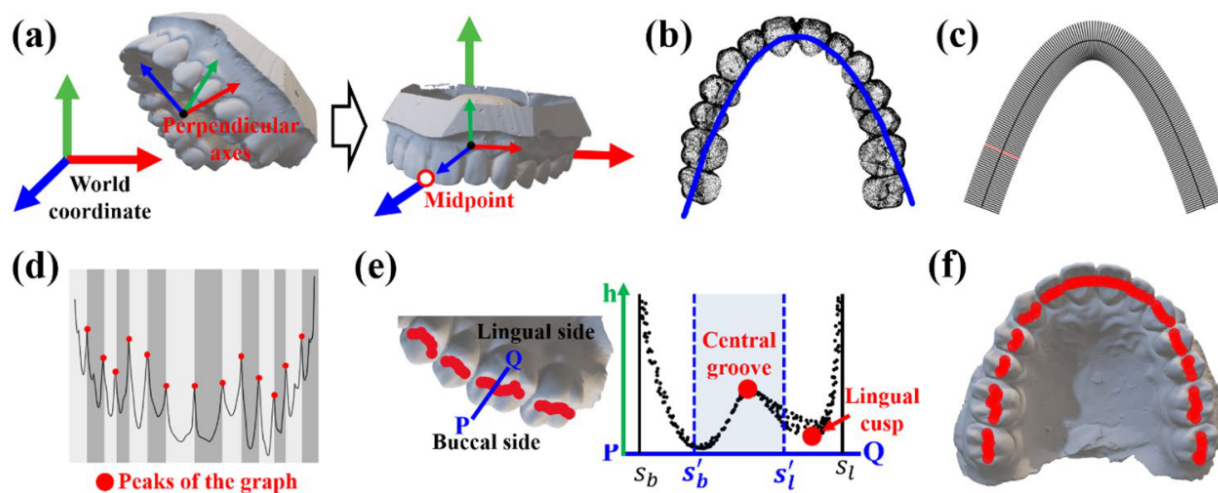


Figure 2. Dental landmark extraction: maxilla alignment, arch-line fit, slicing, central groove, and buccal cusp

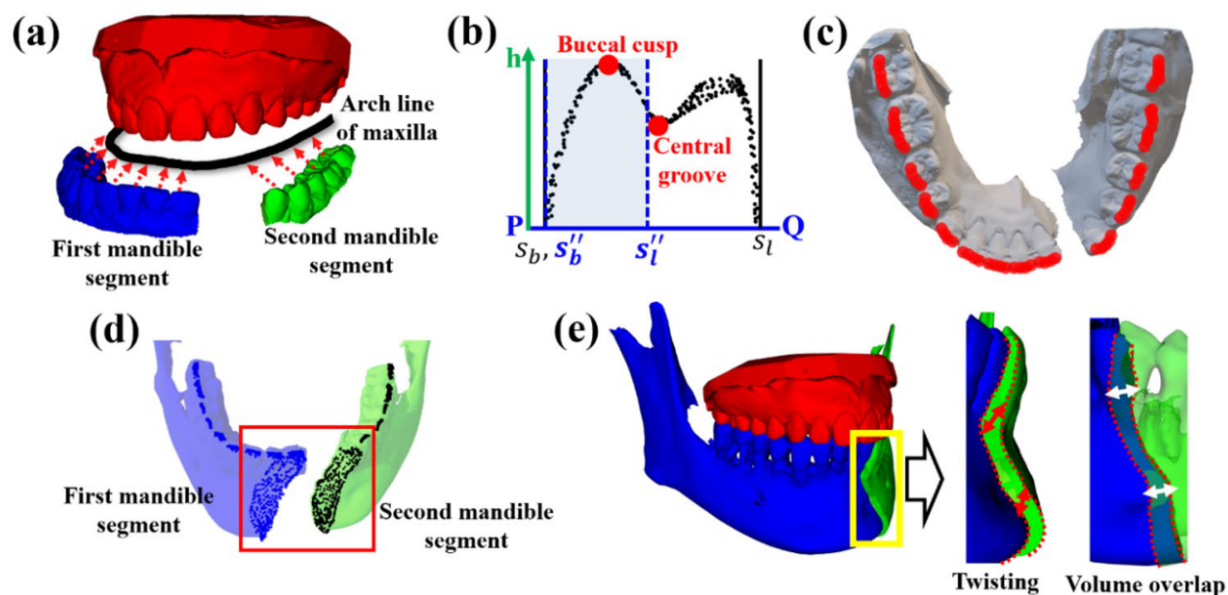


Figure 3. General positioning of fracture segments: arch alignment, fracture-surface features, and overlap error

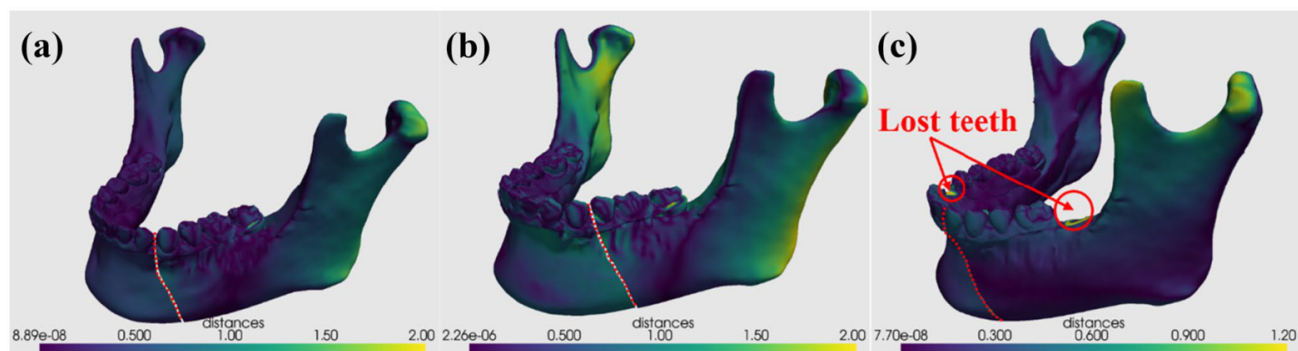


Figure 4. Surface-distance maps for different fracture and tooth conditions: 10-4 split, 11-3 split, two missing teeth

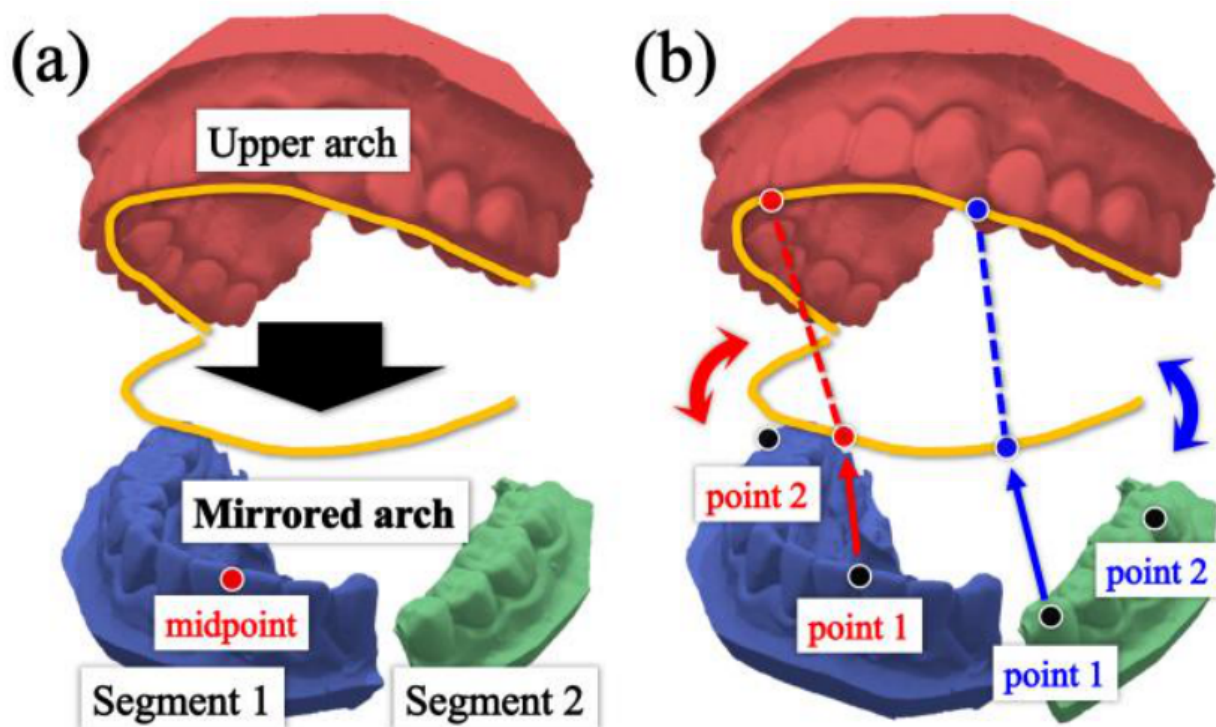


Figure 5. Arch-line-based alignment of mandibular segments (ACCAS 2022)



Figure 6. Presenting at ACCAS 2022, Khon Kaen

Role, team result, and limits

Team result

The joint research team produced international and domestic presentations, an award, and a peer-reviewed publication.

Limitations

Public evidence is the published figures and presentation material; no clinical use or sole first authorship is claimed.

Research boundary

Prepared-dataset results do not establish routine clinical use.

Collaboration boundary

Clinical interpretation, algorithm design, experiment design, and writing were conducted as joint research.

Implementation technologies

Python · Open3D · OpenCV · SciPy · PCA · ICP · CLPSO · 3D Slicer

Primary capability

3D Geometry & Registration · Medical Navigation & Visualization

Registered public evidence

[Publication](#)

What to bring

Share the problem, data or sensors, target validation, and schedule. We can define coordinate and evidence boundaries together.

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