



2021 4th International Conference on
ROBOTICS, CONTROL AND AUTOMATION ENGINEERING

2021年第四届机器人、控制与自动化工程学术会议

RCAE 2021

November 4-6, 2021 | Wuhan Institute of Technology, Wuhan, China

2021年11月4-6日 | 中国-武汉工程大学

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An Internal Arc Fixation Channel and Automatic Planning Algorithm for Pelvic Fracture

CE2049

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Pelvic fracture : **serious injury**

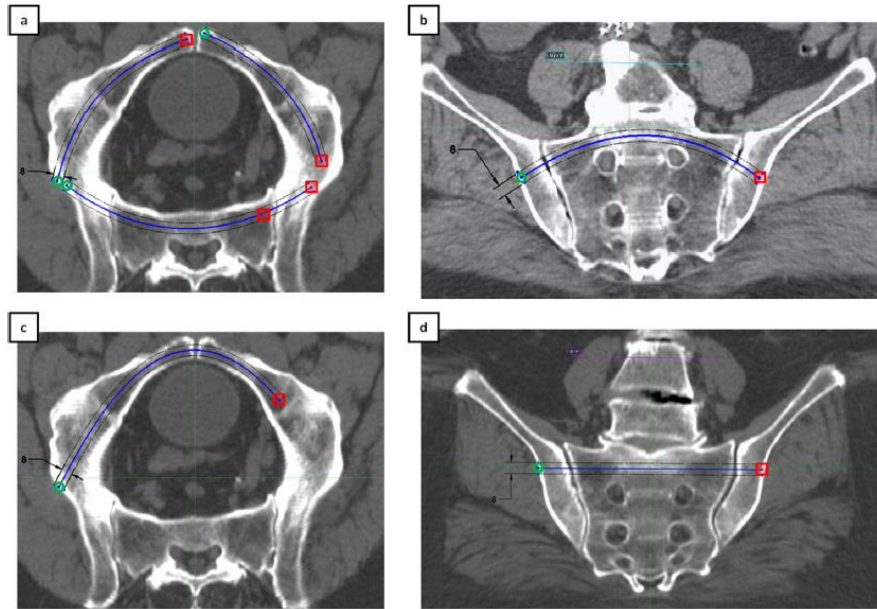
- Highest disability and mortality rate
- Complex anatomy, poor reduction effect
- Poor prognosis with many complications

Treatment : **sacroiliac screw**

- Hard to find fixed channels
- Lack of stability
- Multiple screws



Related research



Is there internal arc fixation channel (IAFC) in the pelvis?

Yes

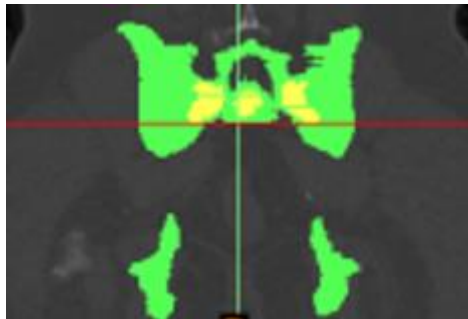
Manual planning & Unknown security

How to generate Internal Arc Fixation Channel (IAFC) automatically with computer assistance?

How to evaluate the security of IAFCs to select the optimal one ?

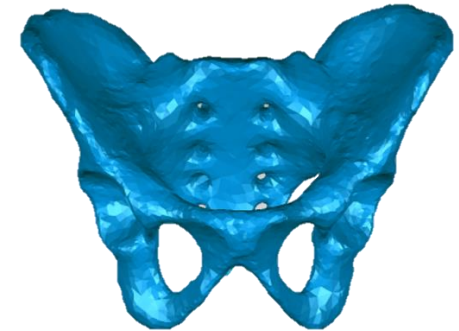
Data acquisition and preprocessing

CT of the pelvic area in ten patients with the intact pelvis



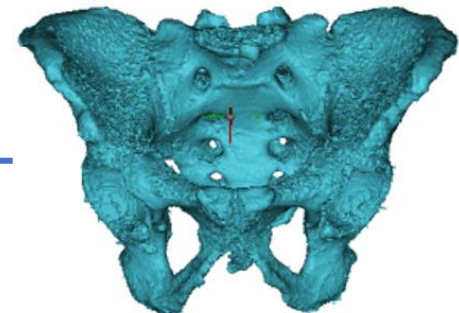
The original CT data

Mimics



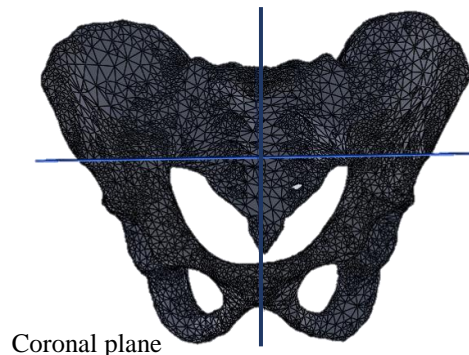
The 3D pelvic model

Geomagic Studio



The optimized pelvic model

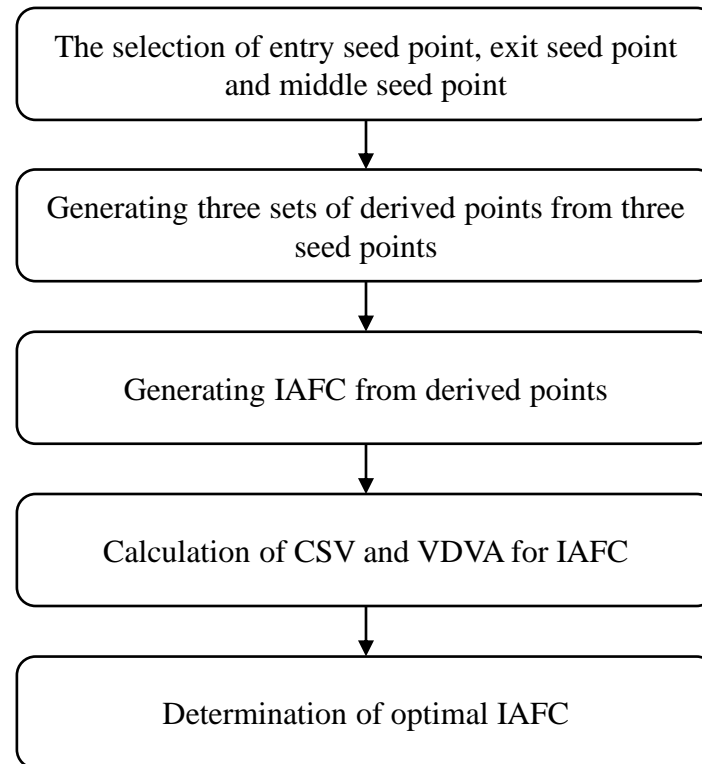
SolidWorks



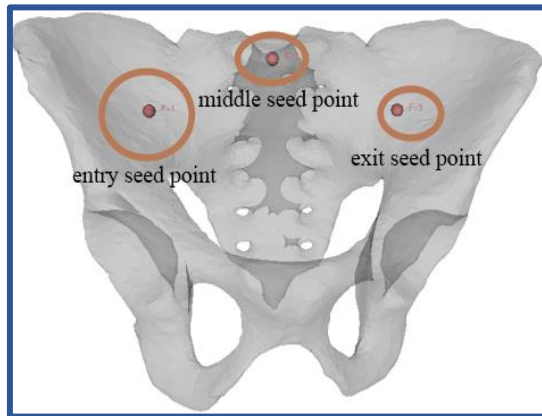
Coronal plane

The final pelvic model

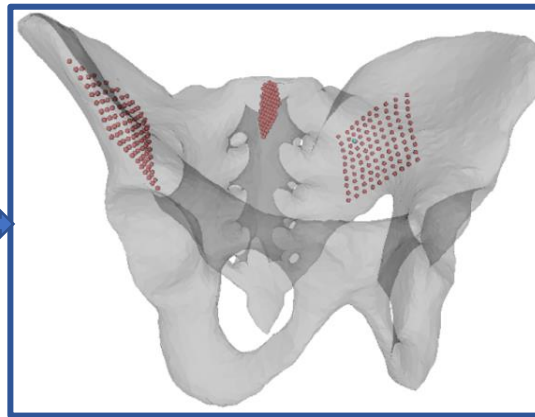
Algorithm design of IAFC



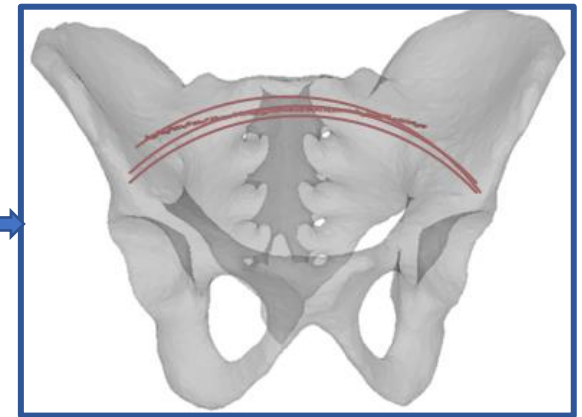
IAFC Generation



The selection of entry seed point, exit seed point and middle seed point

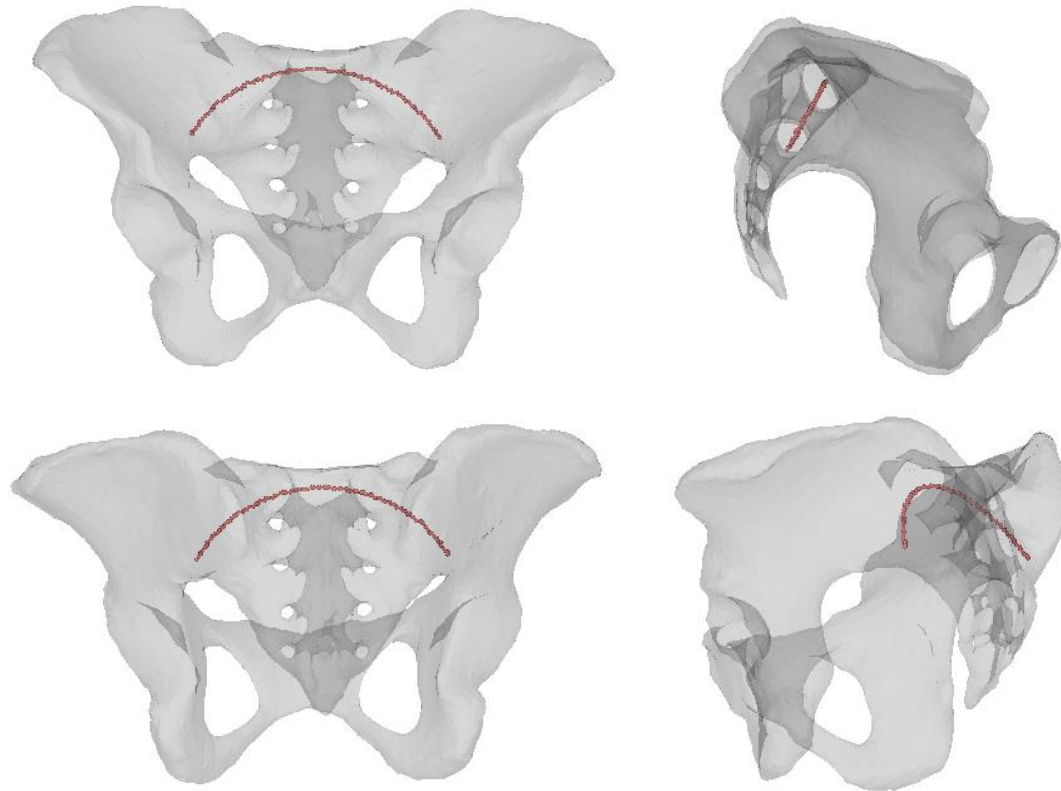


Generating three sets of derived points from three seed points



Generating IAFCs from derived points

IAFC Safety Evaluation

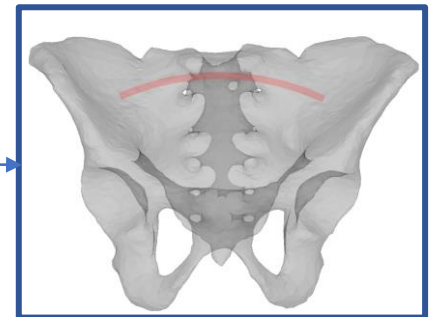
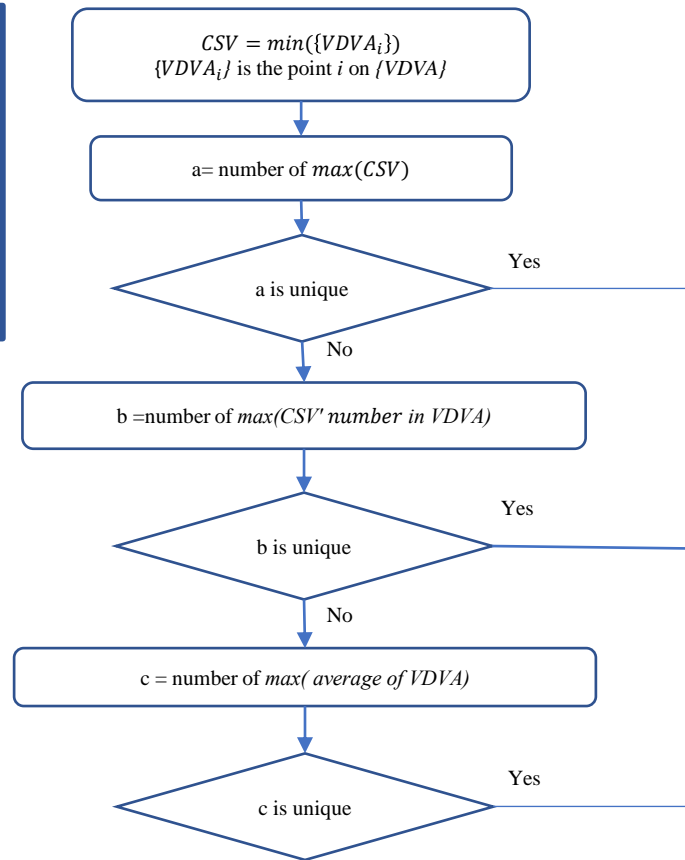
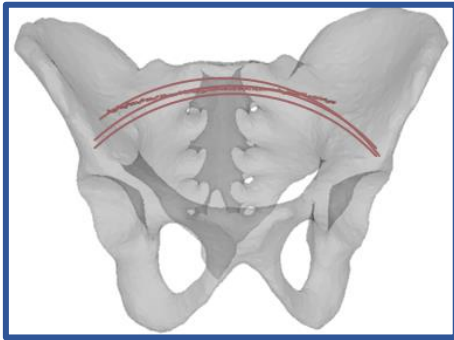


0	0	0	0	0	0	0	0	0
0	1	1	1	1	1	1	1	0
0	1	2	2	2	2	2	1	0
0	1	2	3	3	3	2	1	0
0	1	2	3	4	3	2	1	0
0	1	2	3	3	3	2	1	0
0	1	2	2	2	2	2	1	0
0	1	1	1	1	1	1	1	0
0	0	0	0	0	0	0	0	0

Calculation VDVA for IAFCs
(Two-dimensional schematic diagram of scoring safety values)

[0,1,1,2,2,2,2,1,1,0,0]

Selection of the optimal IAFC



The optimal IAFC

Comparison of the feasibility of IAFC and ISFC

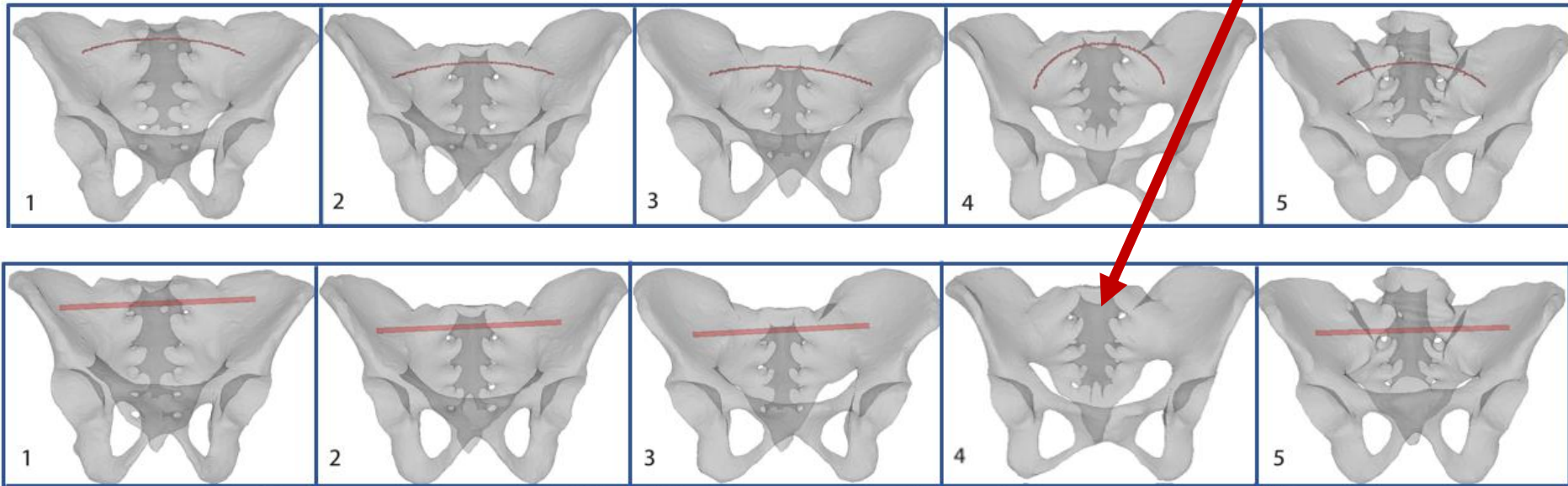
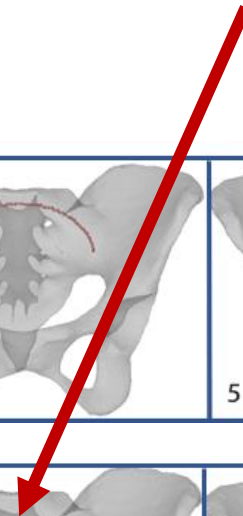
ISFC: homogenous, containing similar lengths and tilts

IAFC: difference across the curvature, location, and tilt

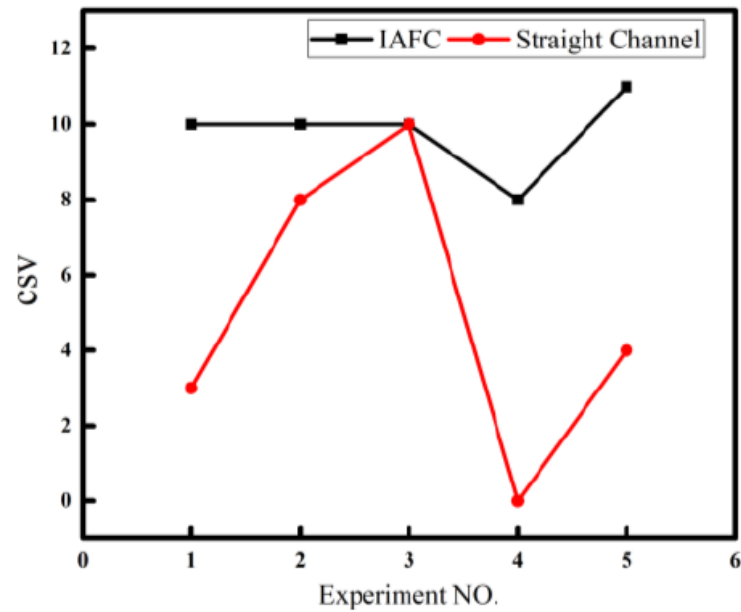
IAFC is more adaptable and flexible.



A viable straight path cannot be found.



CSV comparison between IAFC and straight channel



Parameter comparison of IAFC in the different pelvis

TABLE I. COMPARISON OF PARAMETERS OF IAFC IN THE DIFFERENT PELVIS

NO.	Length (mm)	Curvature	CSV
1	162.82	0.0089	10
2	146.81	0.0078	10
3	141.56	0.0053	10
4	154.86	0.0187	8
5	150.98	0.0126	11

- ◆ There is truly an optimal IAFC in the pelvis.
- ◆ The IAFC has better morphological adaptability and safety than the ISFC.



Thank you

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