ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

3D printing of costal cartilage models with fine fidelity and biomimetic mechanical performance for ear reconstruction simulation

Supplementary File

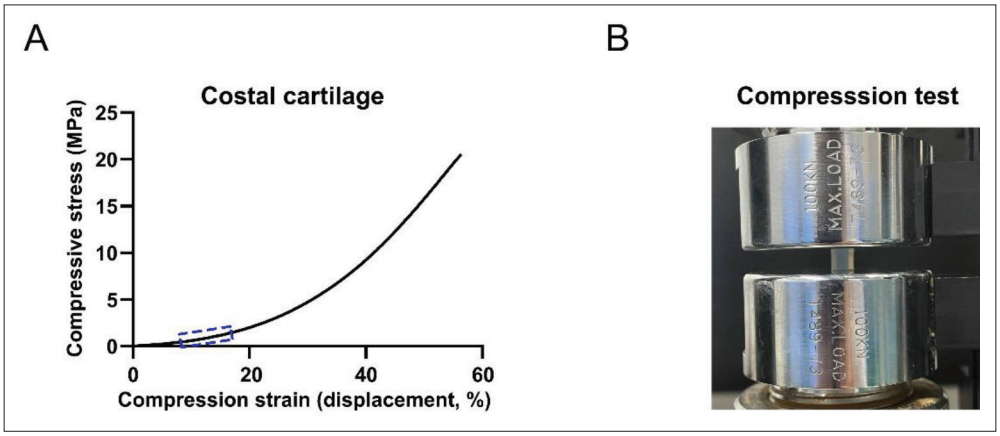

Figure S1. Compression test of costal cartilage. (A) Stress-strain curve of the cartilage compression test results and the value range of Young's modulus. (B) Photographs of the compression test for the costal cartilage sample.

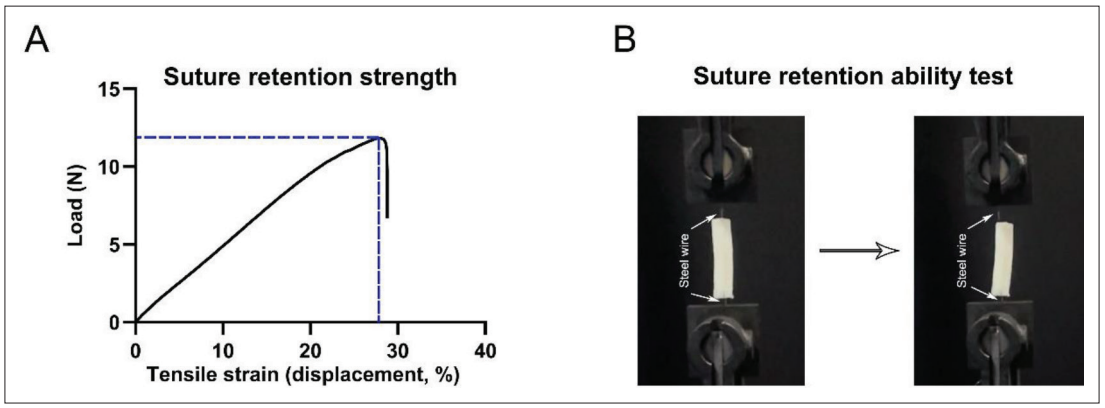

Figure S2. Suture retention ability test of costal cartilage. (A) Stress-strain curve of the suture retention ability test results and value point. (B) Photographs of the suture retention ability test for costal cartilage samples. The white arrows indicate the fine steel wires that pierce the cartilage specimen.

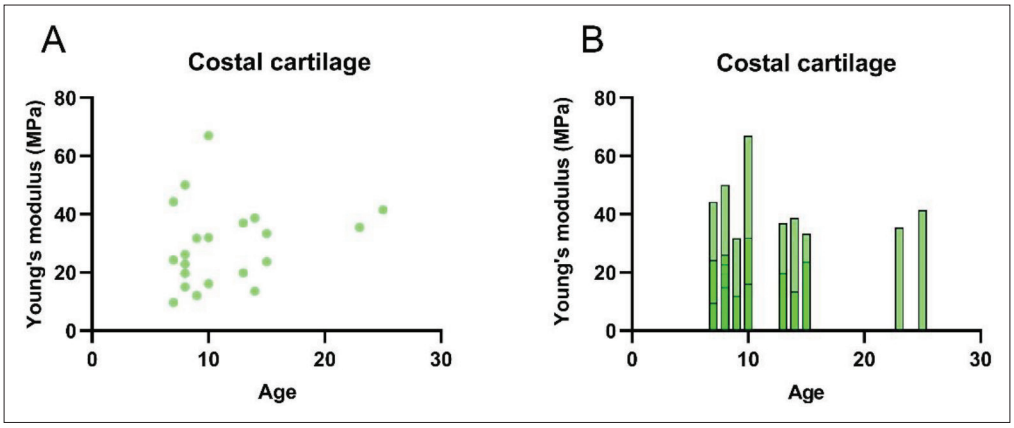

Figure S3. Age versus Young's modulus (A and B).

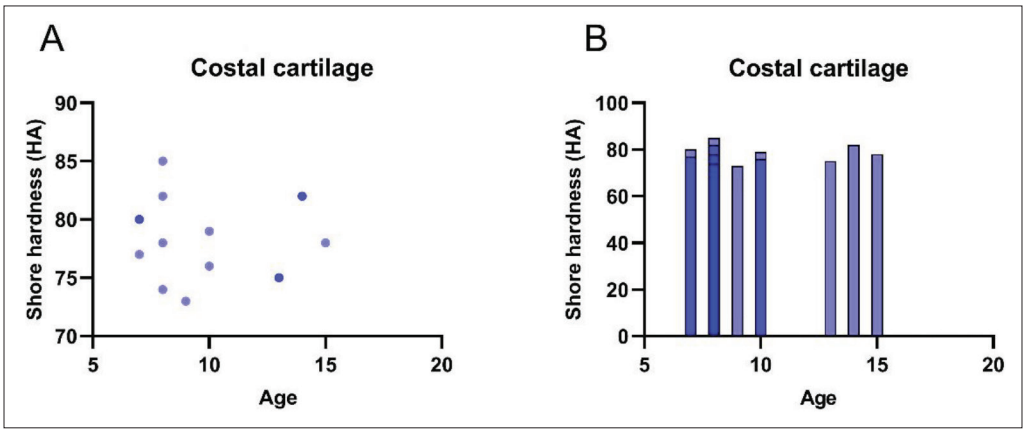

Figure S4. Age versus shore hardness (A and B).

Table S1. Raw materials of 3D-printable silicone (Elkem Silicones, Shanghai, China)

Raw materials	Component A			Component B		
	65 A	75 A	80 A	65 A	75 A	80 A
Vinyl functionalized polysiloxane & reinforced white carbon black	97.48%	97.48%	97.48%	87.72%	79.20%	76.90%
Platinum-based catalysts	0.02%	0.02%	0.02%	-	-	-
Hydrogen-containing polysiloxane	-	-	-	8%	14%	15%
Inhibitor	-	-	-	1.78%	4.3%	5.6%
Vinyl phenyl polysiloxane	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Total	100%	100%	100%	100%	100%	100%

Table S2. Raw materials of supporting material (Elkem Silicones, Shanghai, China)

Raw materials	Supporting material
Nonreactive polymethylsilyne	80%
Reinforced white carbon black	10%
Polyether-containing polysiloxane	10%
Total	100%

Table S3. Parameters of the S300 3D printer

Printing technology	FAM
File format	STL & OBJ
Printing scale	237 × 270 × 150 mm
Printing accuracy	±0.02 mm
Number of printing nozzles	2
Number of carriers	3
Print head diameter	0.2–1.5 mm

Abbreviation: FAM, freeform additive manufacturing printing

Table S4. Overview of collected costal cartilage samples

No.	Age	Sex	Diameter (mm)	Height (mm)	Young's modulus	Shore hardness
1	25	M	6	3.85	41.51	-
2	23	M	6	4.5	35.48	-
3	8	M	6	7.60	19.71	-
4	8	M	6	9.20	50.05	85 A
5	9	F	6	6.05	12.045	73 A
6	15	M	5	3.30	23.72	-
7	13	M	5	3.20	19.91	75 A
8	10	M	5	4.0	67.02	79 A
9	8	F	5	3.1	22.89	82 A
10	13	M	5	4.0	36.99	75 A
11	9	M	5	3.60	31.70	-
12	8	M	5	2.20	15.03	78
13	10	F	5	2.50	31.99	-
14	7	F	5	4.0	44.27	80 A
15	14	M	5	3.95	38.68	82 A
16	14	M	5	4.75	13.567	82 A
17	15	F	5	3.3	33.32	78 A
18	8	F	5	4.1	26.24	74 A
19	10	F	5	3.78	16.15	76 A
20	7	M	5	4.15	24.25	77 A
21	7	M	5	3.5	9.67	80 A

The table is arranged in the chronological order of the tests. The basic information of the patients, sample sizes, and mechanical testing results (modulus and hardness) is recorded in the table.
Notes: M, male; F, female.

Table S5. Dimensions of cartilage and silicone ear frameworks

	Cartilage framework	Silicone framework 1	Silicone framework 2	Silicone framework 3
Length (cm)	5.76	5.85	5.70	5.75
Width (cm)	3.23	3.3	3.20	3.25
Height (cm)	2.05	2.15	2.00	2.18

A paired *t*-test was used to compare cartilage groups and the mean values of silicone groups, and the *p* value was equal to 0.21 ($p > 0.05$).