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We provide technical support for the research conducted by Dr. Hayashi, a dentist at Hayashi Dental Clinic.

1.Dr. Hayashi is analyzing the stress on cortical and cancellous bone when inserting a chisel during implantation procedures, researching methods to prevent bone fracture by applying modifications to the bone.

2.The analysis results of inserting the chisel into the jawbone were validated by experimental results.

3.To reduce stress when inserting the chisel into the jawbone, we have developed chisels with a flat cross-sectional shape. As a result, the force required for inserting the cutting tip is 61% less compared to conventional ϕ2mm chisels, and 58% less for the jiggling tip.

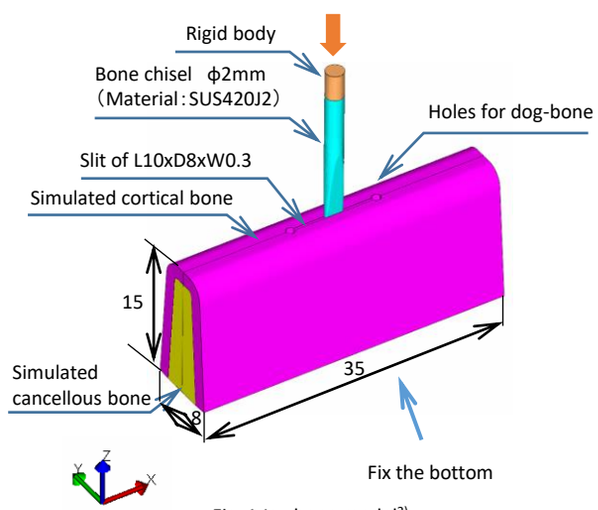


Fig. 1 Jawbone model[2)]

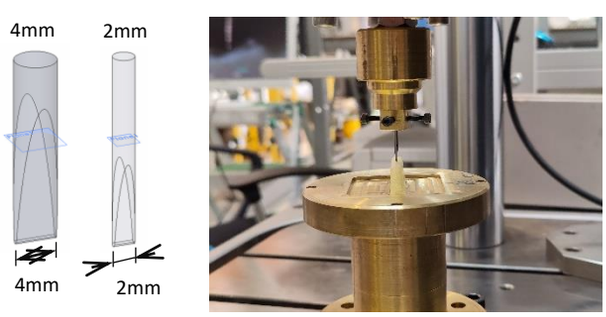


Fig. 3 Insertion test[2)]

Table 1 Properties of simulated bones

	Simulated Cortical bone	Simulated Cancellous bone
Density(kg/m^3)	1100	228
Tensile strength(MPa)	68.23	2.88
Young's modulus(GPa)	2.875	0.13

Strain greater than 400e-6 (red range). The inside of the cancellous bone breaks down.

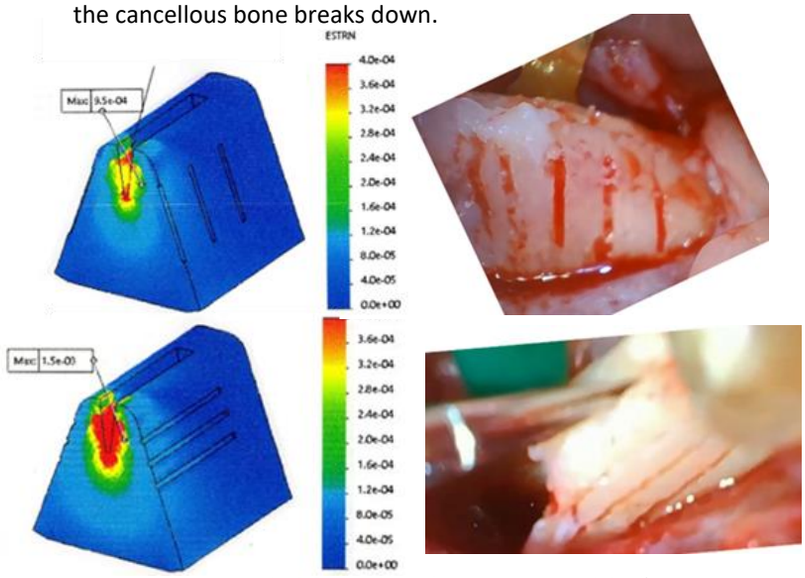
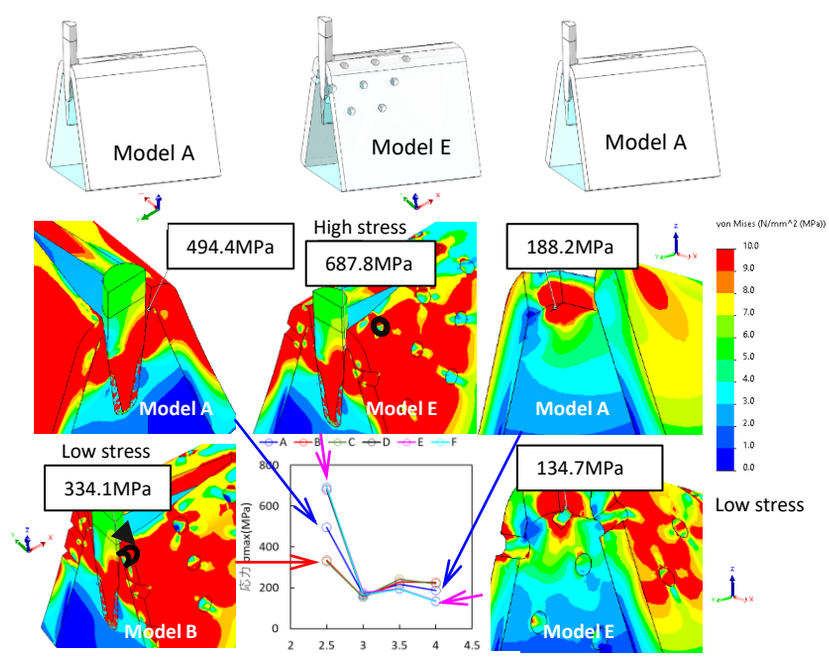


Fig. 2 Comparison of FEM model and clinical[1)]

In actual surgery, sub-slits are inserted and good results are obtained.



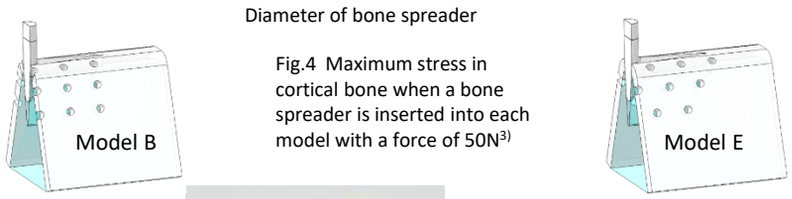


Fig.4 Maximum stress in cortical bone when a bone spreader is inserted into each model with a force of 50N[3)]

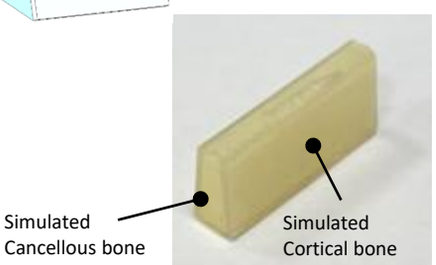


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Fig.5 Prototype of simulated bone

How to expand the slit width from 0.3mm to 1mm [2)]

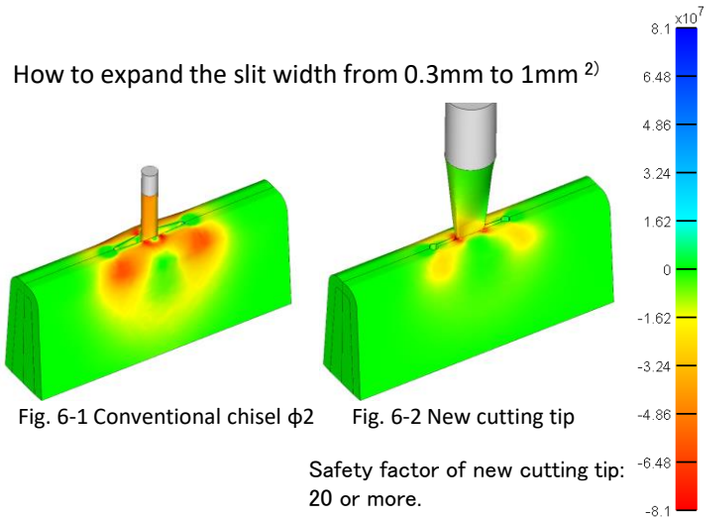

Fig. 6-1 Conventional chisel ϕ2　Fig. 6-2 New cutting tip

Safety factor of new cutting tip: 20 or more.

How to expand the slit width from 1mm to 2mm [2)]

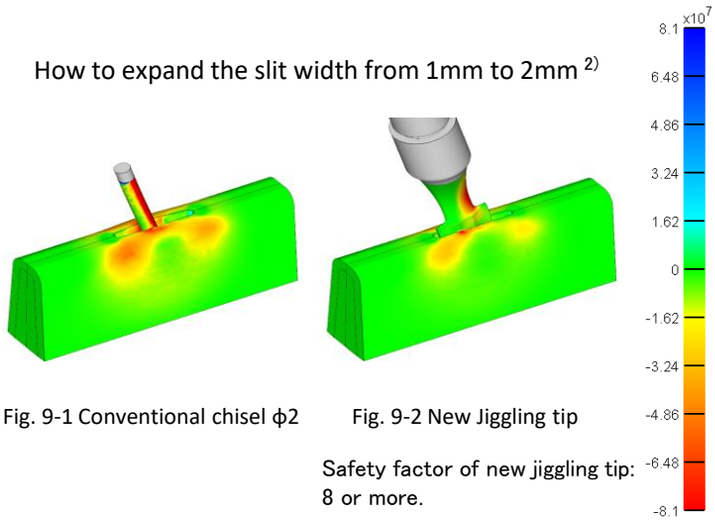

Fig. 9-1 Conventional chisel ϕ2　Fig. 9-2 New Jiggling tip

Safety factor of new jiggling tip: 8 or more.

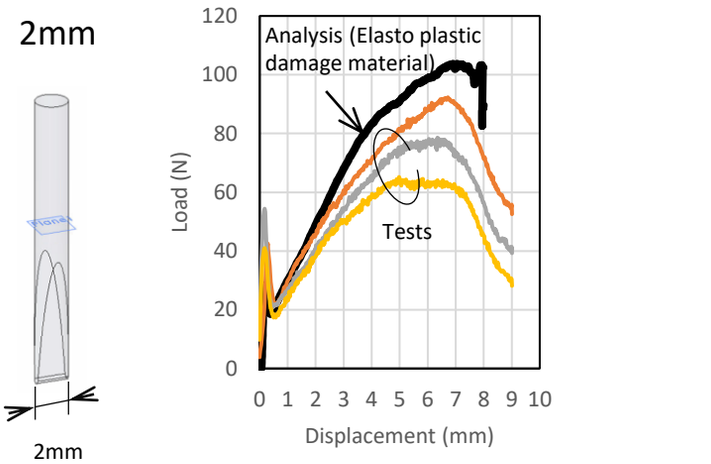

Fig. 7 Relationship between displacement and load of a bone chisel with a blade width of 2 mm (dog bone slit)[2)]

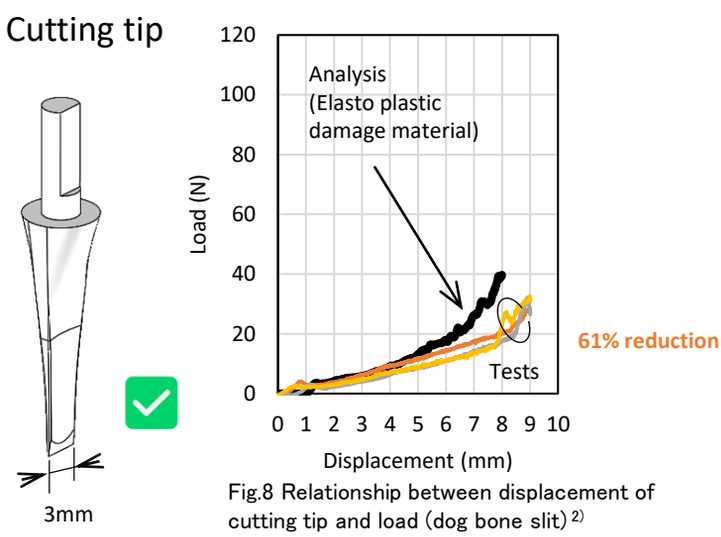

Fig.8 Relationship between displacement of cutting tip and load (dog bone slit) [2)]

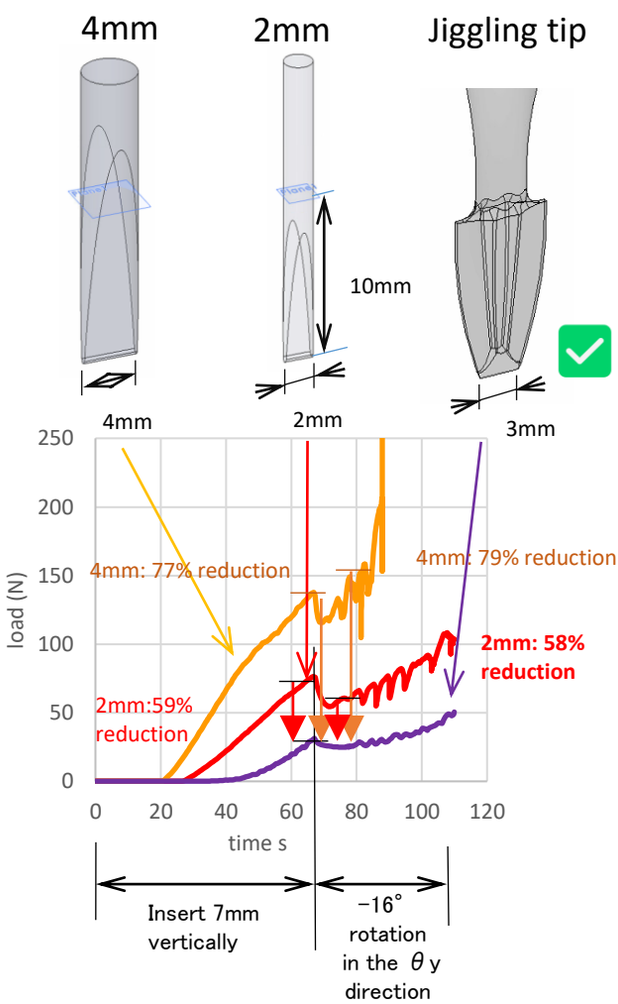

Fig. 10 Comparison between conventional and new jiggling tips [2)]

In addition to developing bone chisel, Dr. Hayashi is also working on verifying mouthpiece correction and developing navigation using AR glasses. We are looking for a partner company that has technology that can combine intraoral images with images of implants, blood vessels, and mucous membranes and output them to smart glasses. If you are interested in his research content, please let us know.

<References>

1) Hayashi, S. (2022), “Considerations from the finite element method part1”, *Implant Journal 2022, No.90*, pp.81-90, ZENITH PRESS, Japan

2) Hayashi, S. (2022), “Considerations from the finite element method part2”, *Implant Journal 2022, No.92*, pp.109-120 , ZENITH PRESS, Japan

3) Hayashi, S. (2023), “Considerations from the finite element method part3”, *Implant Journal 2023, No.93,* pp.123-130 , ZENITH PRESS, Japan

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