INDIVIDUAL STRESS ANALYSIS OF THE HUMAN MANDIBLE UNDER A BITING CONDITION

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INTRODUCTION

Our purpose is to examine mechanical characteristics of the human mandible. It has two essential problems to be solved for execution of reliable stress analyses. One is that the mandibular body has a complicated shape. The other one is that the mandibular body receives various masticatory forces under a biting condition.

METHODS

To examine mechanical characteristics of the human mandible, we developed an automated modeling method to generate the ¯nite element model from CT images of the mandible. Next, we provided a mechanical condition under a bilateral biting. We estimated the masticatory forces and the directions from the same CT images as shown in Table 1 considering a probable mechanical condition as in Fig. 1. As the mandible has symmetrical shape in this case, the biting condition was provided to be symmetrical. We also took into consideration of attachment sites of muscles to the ¯nite element model.

Table 1: Masticatory forces [N]

Masseter		268.6
Pterygoideus medialis		161.1
Pterygoideus lateralis		53.71
Temporalis	anterior	134.3
	central	67.14
	posterior	67.14

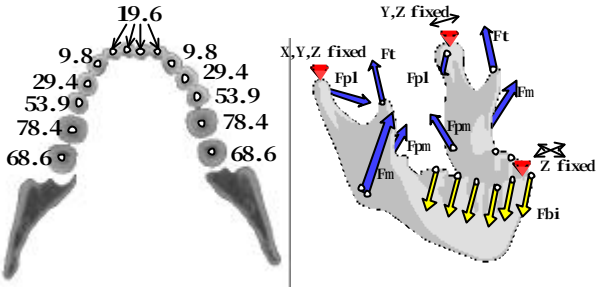

Fig.1: Biting condition

RESULTS

The automated modeling method successfully generated the exact ¯nite element model. The stress analysis was executed by a general-purpose structural program, CAFEM(Concurrent Analysis Corp.,CA,USA). Figure 2 shows the computational result with equivalent stress. Several regions of the mandible are highly stressed.

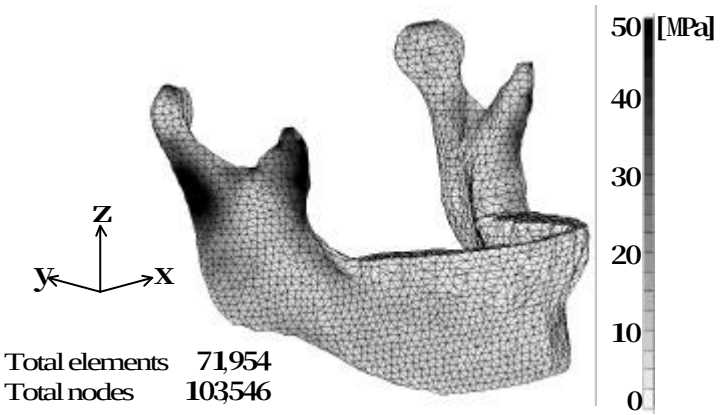

Fig.2: Stress distribution of mandible

DISCUSSION

Actual mastication of the human mandible is composed of various types of biting. Our further study is to analyze stress distributions under these biting conditions. We expect that superposition of the stress distributions clarify the mechanical characteristics of the mandible.

CONCLUSION

An individual simulation method of the human mandible based on X-ray CT data was proposed. The proposed computational method will be useful to medical diagnosis and treatment as we can analyze a musculoskeltal system with the specialized model of each individual.