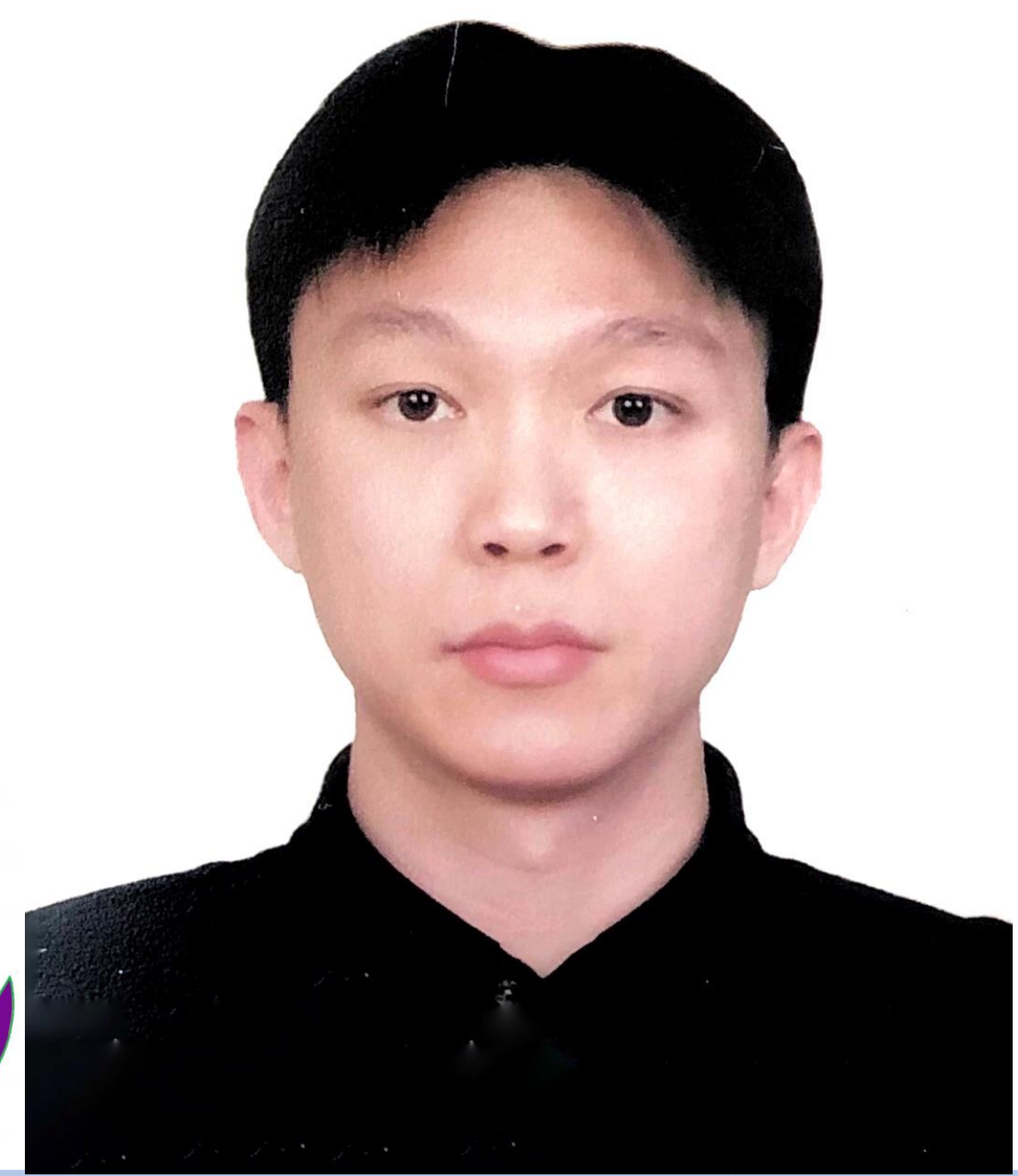


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Background

Anterior open bite (AOB) is defined as a malocclusion with no incisal contact between anterior teeth in centric relation [1,2] In previous studies, disuse atrophy due to occlusal hypofunction in AOB malocclusion might have resulted in increased pulp size, whereas root dimension, periodontal ligament thickness and dentin width were decreased. [3,4]

Dental pulp is connective tissue that resides within the tooth and consists of variety of cell types. [5,6] The pulp/tooth volume were earlier reported in normal bite patients. [7] However, the differences of pulp volume between AOB malocclusion and anterior normal bite has not been investigated in previous studies. We hypothesized that occlusal hypofunction in AOB malocclusion may justify an increased dental pulp cavity volume.

Materials and Methods

Subjects were patients requiring pretreatment CBCT images. The inclusion criteria: age 15 - 30 years, Class I skeletal relationship, presence of all permanent teeth, complete root formation and no history orthodontic treatment. All patients obtained lateral cephalometric radiography and CBCT (NewTom Giano, Verona, Italy) and then were traced using Dolphin imaging version 11.9. Subjects were assigned into 2 groups according to the vertical configuration. The normal group had anterior normal overbite and a normal vertical skeletal configuration. The AOB group had AOB and an open vertical skeletal configuration. The CBCT images were taken at a voxel size of 0.16 mm, 90 kV and 8 cm × 8 cm field of view. DICOM files were converted to the STL files using Mimics Research software version 17.0, Materialise, Leuven, Belgium. All data was summarized by mean and SD. Comparison of means of pulp cavity volume, tooth volume and the volume ratios between the groups was performed using the independent samples t-test analysis.

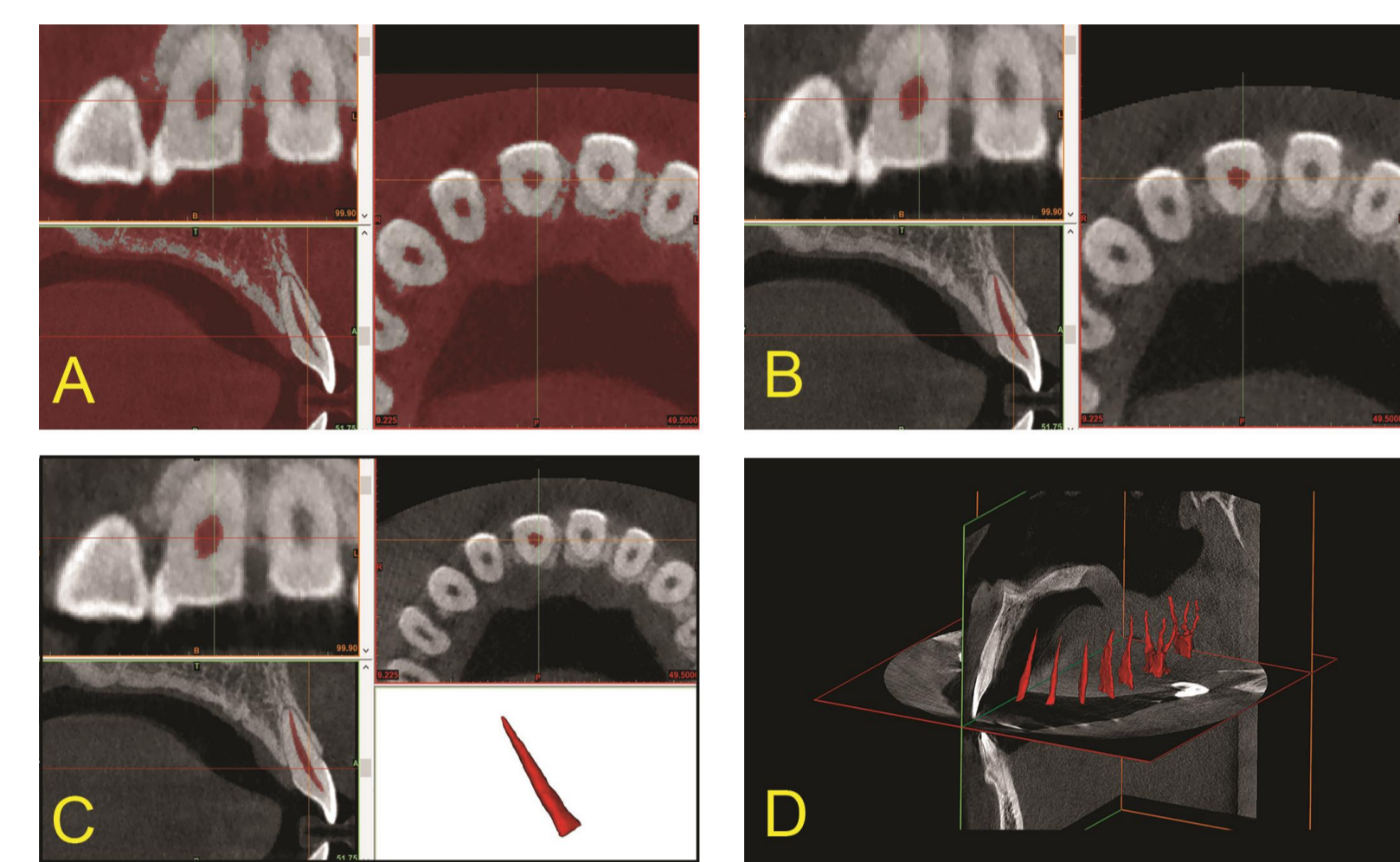


Fig. 1 A mask of the areas of interest was created by predefining of threshold value.(A-B) 3D tooth models were constructed.(C) The CEJ was marked to separate the crown and the root. By using 3-matic research software the volumes of each tooth was calculated. The final image of all types of tooth pulp cavity is shown.(D)

Results

The overall sample included 44 patients who met the inclusion criteria. The mean age of the patients was 19.7 ± 2.9 (17 males and 27 females). All data in both groups was normally distributed. The means of the pulp cavity volume of the maxillary central incisor, lateral incisor and canine in the AOB group were significantly greater than the normal group ($p < 0.05$) (Fig. 2). The root canal volume of the central and lateral incisor were significantly larger in the AOB group ($p < 0.05$) (Fig. 2). Furthermore, the root volume of the maxillary central incisor, lateral incisor and canine were significantly smaller in the AOB ($p < 0.05$), whereas no significant statistical

differences in crown volume were found between two groups (Fig. 3).

The means of the total pulp cavity/ tooth volume ratio of the AOB group were significantly greater than the normal group in the maxillary central incisor ($p = 0.001$), lateral incisor ($p = 0.00025$) and canine ($p = 0.004$). Furthermore, the means of the root canal/ root volume ratio of the AOB group was significantly greater than those in the normal group in the central incisor ($p = 0.00001$), lateral incisor ($p = 0.00007$) and canine ($p = 0.001$).

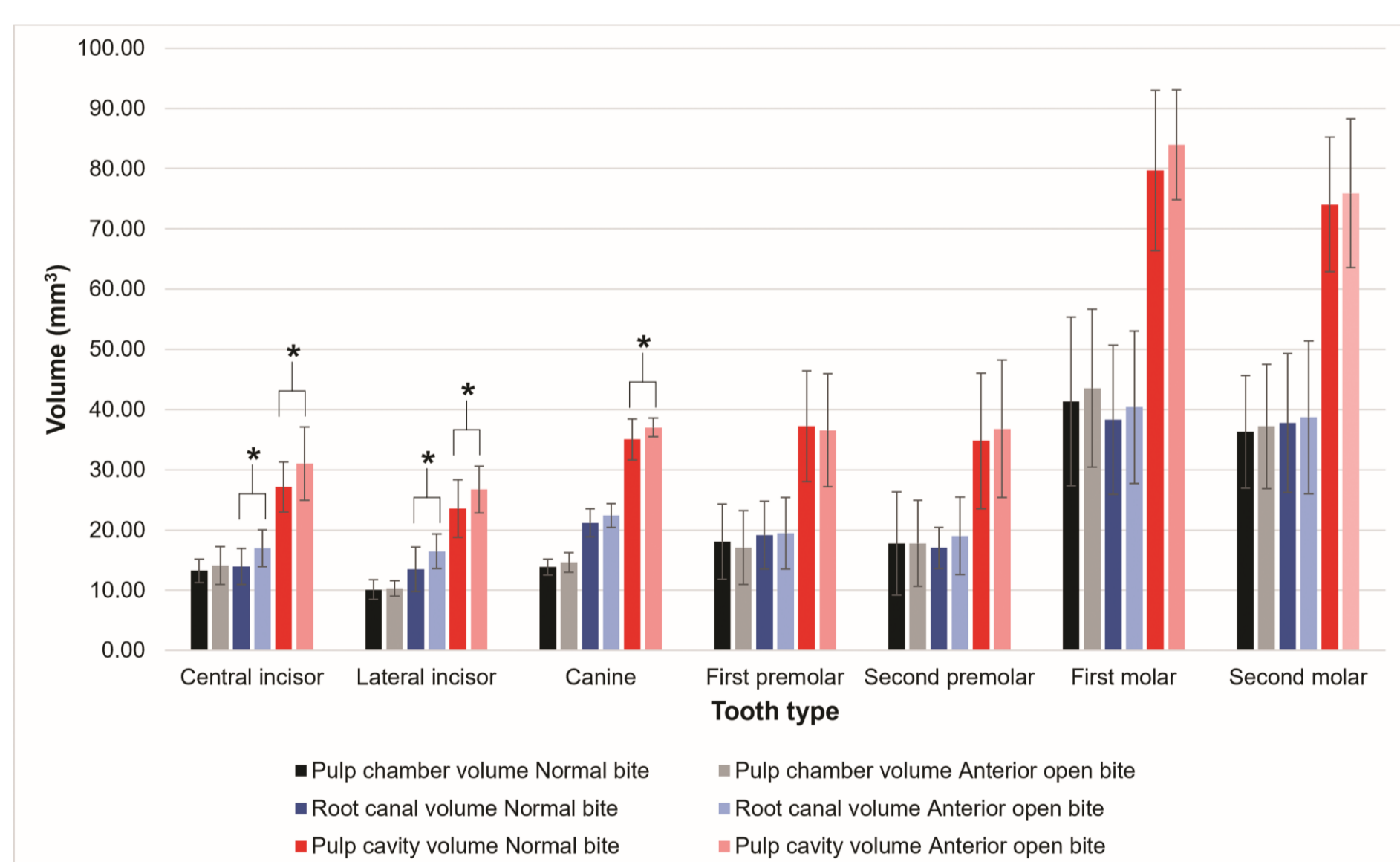


Fig. 2 The bar graph illustrates a comparison of the pulp cavity volume of the maxillary permanent teeth (*, $p < 0.05$)

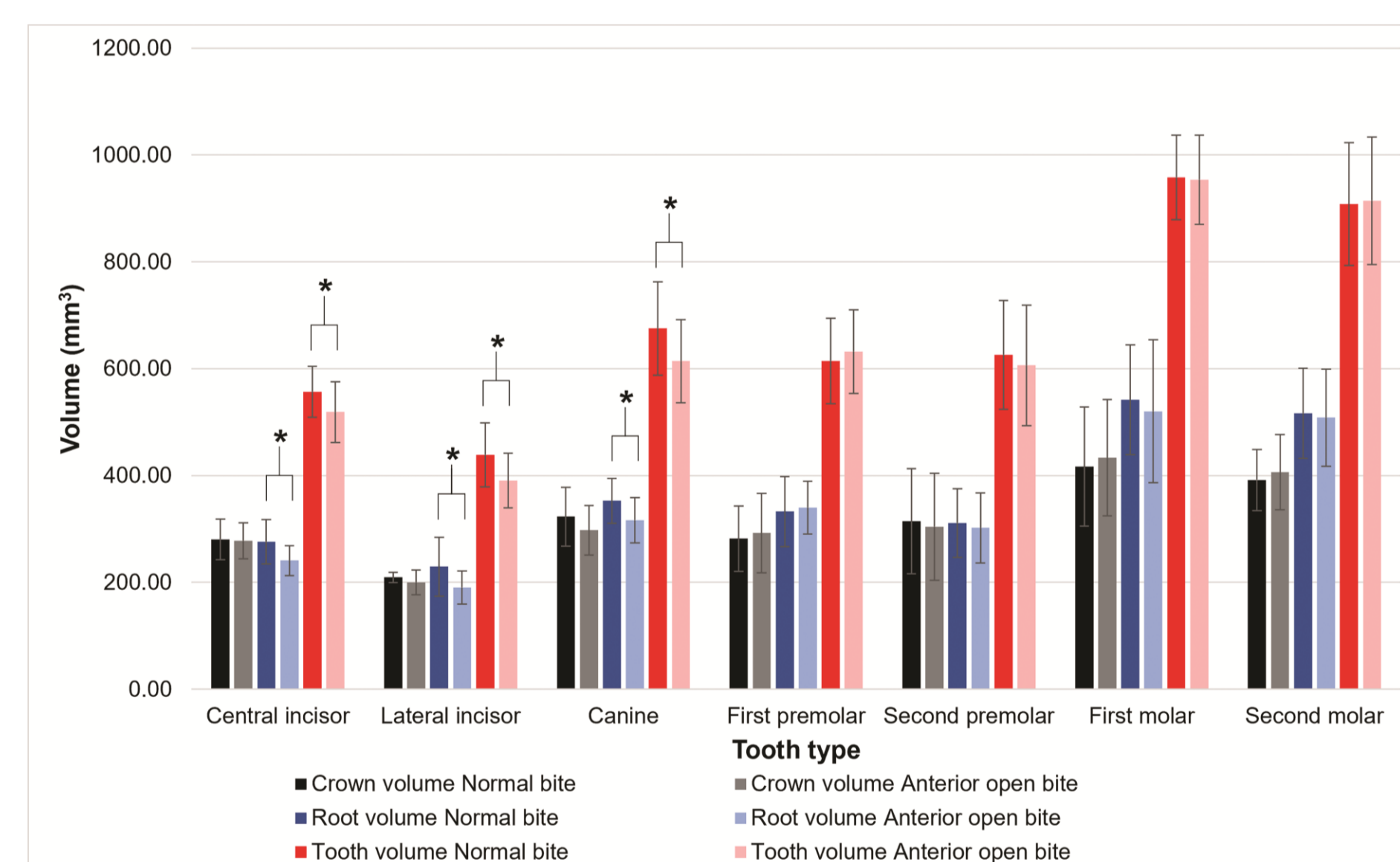


Fig. 3 The bar graph illustrates a comparison of the tooth volume of the maxillary permanent teeth (*, $p < 0.05$)

Discussion and Conclusion

The present study reported that there was an increase of dental pulp cavity volume only in the anterior teeth in AOB malocclusion. This might be associated with occlusal hypofunction due to the loss of occlusal contact in nature of the AOB malocclusion. The results are consistent with previous studies, suggesting that the hypofunctional teeth are generally characterized by enlargement of the pulp size and decrease of the dentinal wall thickness [3,4]. This might be explained by the life cycle of the odontoblasts [3]. The life span of hypofunctional odontoblasts are half of the normal odontoblasts with declined dentin production [3,8]. According to the results,

it is necessary that orthodontic forces should be applied carefully to avoid the occurrence of undesirable root resorption in patients with anterior open bite malocclusion due to concomitant large dental pulp cavity and less root volume.

In conclusion, AOB bite malocclusion might lead to an increase of the pulp cavity volume and decrease of the tooth volume due to occlusal hypofunction.

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