Optimal structural design evaluation of magnetic attachments using three-dimensional finite element method

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Magnetic attachments are designed to exert an attractive force at clinically useful levels. However, improvement of the attractive force is necessary, in order to deal with complexed clinical conditions. The present study analyzed and investigated magnetic attachments from the point of a magnetic circuit using a three-dimensional finite element method to enhance the performance of magnetic attachments.

An analysis model was constructed based on a dental magnetic attachment (GIGAUSS D 600, GC). Round non-magnetic material was embedded in 1) the disk yoke only , 2) the keeper only and 3) both the disk yoke and keeper in the analysis model. Magnetic flux density distribution and attractive force were analyzed by changing the diameter of non-magnetic material by 0.05 mm.

An increase in magnetic flux density on the attractive surface was confirmed by embedding non-magnetic material to the magnetic assembly and the keeper. However, magnetic flux density was oversaturated when it exceeded a certain value. A similar tendency was observed in attractive force.