APPLICATION OF THE GEOMETRICAL BIOMODELS FOR AUTOTRANSPLANTATION OF IMPACTED CANINES

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INTRODUCTION

There are various methods available for the treatment of impacted canines (orthodontic treatment, autotransplantation of impacted canine to its correct position, extraction). There are advantages and disadvantages with each method. The choice of the best approach depends on the characteristics of each case. Autotransplantation may be considered as suitable method in cases of severe impaction. The aim of this poster is to present the possibility of use geometrical biomodels (1:1 copy of living transplanted tooth) of teeth intended for autotransplantation during this surgical procedure.

RESULTS

The canine biomodels represents its true-to-size replica (Fig. 6e). Its accuracy depends mainly on source CT data resolution, which is typically ~0.5 mm. Accuracy of virtual models creation process is ~0.1 mm. Accuracy of materialization process is ~0.05 mm. Biomodel can replace the transplant especially in the phase of the recipient alveolus preparation. It is possible to insert the biomodel into the prepared alveolus and try its size (Fig. 6c). Biomodel inserted in the prepared alveolus will permit to check articulation and the position in respect of occlusion (Fig. 6d). Recipient alveolus should be sufficient to allow placement of the transplant without impinging on alveolar bone or the opposing teeth in occlusion. For the whole time of the recipient alveolus preparation the donor canine may stay in its original place. Thus, the extraalveolar period of autotransplantation is decreased to a minimum. The periodontal ligament on the transplant surface is not endangered by drying or by the use of chemicals on the root surface. Correct knowledge of impacted canine position obtained from CT data allows its easier extraction. We have realized seven autotransplantations with use of the biomodels from summer 2003.

SUBJECTS AND METHODS

Patients with severely impacted permanent canines underwent a CT examination (Fig. 1, Fig. 2, Fig. 3a, Fig. 4). Data produced by CT were used to creation of the geometrical biomodels of impacted canines in our special computer system. The creation process consists of several steps:

- tissue segmentation (canine intended to transplantation) of the input CT data (Fig. 3b)
- segmented CT data vectorisation by „Marching cubes method“ (Fig. 5a)
- smoothing of created models by „Geometric signal processing method“ (Fig. 5b)
- reduction of triangles number by „Surface simplification quadric error method“ (Fig. 5c)

Created virtual (computer) models of canines are materialized by milling technology (5D CNC router). Material used for models were Ebalsa 2000 resin and bone cement. Canine biomodels were used during autotransplantation itself.

CONCLUSIONS

The use of a biomodel shortens the extraalveolar period of autotransplantation and minimizes the risk of mechanical damage to the tooth transplant periodontal ligament. It is to presume that the use of biomodels in autotransplantations will lead to a greater success of this type of procedures. Supported by Project No. 1M0021622409 (CZ)