Orthodontics Treatment using Three Dimensional Model Simulation

Expanding the Reach of Digital Orthodontics

The use of digital models in orthodontics is rapidly increasing as the industry undergoes analog to digital conversions in record keeping. More than 2 million new orthodontic patients are started each year, and the 3D Dental Models for Computer Automated Treatment Simulation could be used for the orthodontics treatment of all patients. The current use of computerized treatment simulation tools is limited because of heavy reliance on human input to segment the dental arch into individual tooth objects. The 3D Dental Models for Computer Automated Treatment Planning requires little human input because it automatically separates the gums and teeth from one another. This software enables clinicians to ensure, in a virtual setting, that the selected treatment will produce the optimal outcome, with minimal user input.

Automatic Segmentation Improves Accuracy and Reduces Reliance on User Input

The 3D Dental Models for Computer Automated Treatment Simulation is among the first available software tools that can automatically separate the teeth within the digital model. The separation into individual tooth objects is called segmentation. This is an essential step in orthodontic treatment because it allows the teeth to be manipulated and aligned into the appropriate positions in each arch, matching the upper and lower arches. Different kinds of approaches using two dimensional methods for three dimensional models have been published in the scientific literature, but the resulting segmentation is not satisfactory. Models from laser scans have errors due to malocclusions which result in poor accuracy in determining the inter-tooth boundary. Automatic segmentation used by the 3D Dental Models for Computer Automated Treatment Simulation requires less user input and handles malocclusions well.

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**Automatic Dental Arch Segmentation**

Digital treatment planning starts with the creation of a three-dimensional digital model of the patient's dental arches. These models are produced by laser-scanning solid plaster models built using dental impressions. The 3D Dental Models for Computer Automated Treatment Simulation provides orthodontists with a segmentation method that can identify the gums and teeth faces correctly and automatically separates the gums from the teeth. (By removing the gums, the orthodontist can potentially do a more accurate simulation of tooth movement over time.) After removing the gums, the software automatically segments the teeth into each individual tooth object. Interstitial points are detected and an algorithm is used to match the corresponding pairs. The algorithm matches the interstitial points and draws curves to naturally separate the teeth. The 3D digital model allows orthodontists to manipulate and align individual teeth, saving time and money by removing the requirement to manually segment the dental arches.

**Computer Automated Treatment Simulation is Efficient and Cost Effective**

New orthodontic treatment methods require the use of digital laboratories to complete the treatment simulation. The existing digital laboratories are very expensive because of the need for user input in the segmentation process. The software that is currently available is very time consuming and only used in the most complex cases. By removing the reliance on user input and enabling automatic segmentation, the 3D Dental Models for Computer Automated Treatment Simulation make the use of digital laboratories more practical. The 3D Dental Models for Computer Automated Treatment Simulation meet the needs of digital laboratories, by providing a more efficient and cost effective method for completing the segmentation process.

**BENEFITS OF 3D DENTAL MODELS FOR COMPUTER AUTOMATED TREATMENT SIMULATION**

- Automatic segmentation requires minimal user input--noise in upper jaw can be easily removed with a single click
- Less time consuming and less expensive--automatic segmentation removes the reliance on user input.
- Improves accuracy--automatic separation of gums and individual teeth within digital model.
- Handles malocclusions well -- notable improvement over existing methods.

**Phase of Development** This technology has been exclusively licensed.

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