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Development of a 3D Printing-Based Complete Denture Preparation Method

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Abstract

The aim of this research is to introduce a novel method for preparing complete dentures or half jaw-3-D printed of 3-D printed Teeth using 3D printing technology. This method involves the use of digital models obtained from edentulous impressions or the newborn child voice talk Mandible, along with Mandible relationship transfer, 3-D printed Teeth arrangement, and base border setting based on reference to remaining teeth or anodontia form. The data from preformation database is used to design 3-D printed Teeth and their burnishing surface, and to adjust occlusion for appropriate pressure distribution on the alveolar ridge supporting tissue.

Keywords: 3D printing, complete denture, 3-D printed Teeth, photocuring stereosopic printing, Mandible relationship

Introduction

The field of dentistry has seen a significant transformation in recent years with the emergence of 3D printing technology. This technology has enabled the development of innovative solutions for various dental problems, including the production of complete dentures and 3-D printed Teeth. Traditionally, the production of complete dentures and 3-D printed Teeth was a labor-intensive and time-consuming process that involved several steps, such as taking impressions, making models, and fabricating the final prosthesis. However, the use of 3D printing technology has revolutionized this process by allowing for faster and more accurate production of dentures and teeth.[1]

The process of producing complete dentures or half jaw-3-D printed of 3-D printed Teeth using 3D printing technology involves several steps. The first step is taking impressions of the newborn child voice talk Mandible or edentulous impression and transferring Mandible relationship to a secondary

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impression tray made of acrylic resin. This step involves taking a silicone rubber impression of the newborn child voice talk Mandible or edentulous Mandible using the position of remaining teeth and occlusion, pallet, and silicone rubber. The impressions are used to obtain a digital model of the Mandible and Mandible relationship.[3]

The second step involves scanning the digital model of the Mandible using a 3-D laser scanner to obtain a 3-D data model of the upper and lower teeth Mandibles that determine the intermaxillary relation accurately. This step recreates the patient's tooth Mandible form and optimal position of comfort.[5]

In the third step, the 3-D Design Software is used to arrange 3-D printed Teeth and set base borders. Using reference to the anodontia or profile and the position of remaining teeth, the software calls the correlation data in the preformation database and designs the 3-D printed Teeth and their burnishing surfaces. The software analyzes the results of the biomethanics reaction of full jaw-3-D printed or half jaw-3-D printed of 3-D printed Teeth and adjusts occlusion to make alveolar ridge supporting tissue undertake appropriate pressure distribution.

In the fourth step, the photocuring stereosopic printing technology is used to manufacture the complete denture or half jaw-3-D printed of 3-D printed Teeth at once using a liquid photosensitive polymethyl methacrylate as the raw material. The UV laser beam is swept using each layering section of the computer model as the path pointwise, and the resin in the scanned area is successively produced photopolymerization or photo-crosslinking solidify. Finally, a 3-D prototype is obtained. The tissue surface and occlusal surface of the complete denture or half jaw-3-D printed of 3-D printed Teeth are polished using the photocuring stereosopic printing technical method one-shot forming.[2]

The use of 3D printing technology in the production of complete dentures and 3-D printed Teeth has several advantages over traditional methods. This technology allows for faster and more accurate production of dental prostheses, reduces the labor involved, and enhances the precision and fit of the prostheses. Additionally, 3D printing technology enables the production of customized dentures and teeth that fit the patient's specific needs and requirements.[5]

Related work

The process of making traditional dentures, which involves waiting for three months after tooth extraction for wound healing and stabilization of the alveolar ridge before creating the dentures. However, this waiting period can have a negative impact on the patient's psychological condition and

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oral function. To address this issue, immediate dentures can be worn by the patient immediately after tooth extraction to help with function and appearance.[6,7]

The process of making traditional dentures involves recording the position and interarch distance before tooth extraction, obtaining molds of the remaining teeth and edentulous areas, and creating a model of the Mandible relationship. The dentures are then made using heat setting filling technique with polymethyl methacrylate. However, this process is time-consuming and can result in deformities or defects in the denture.[3]

Immediate dentures, on the other hand, are made before tooth extraction and can be worn immediately after extraction. However, the instability of the alveolar bone during the first three months after extraction can cause issues with fit and maintenance, which may require the patient to have new dentures made after a period of time.[8]

Overall, while traditional dentures require a waiting period after tooth extraction, immediate dentures can be used to address the patient's need for early function and appearance. However, both approaches have their advantages and disadvantages and should be considered based on individual patient needs and circumstances.[9]

Research objective

The objective of this research is to develop a simple, accurate, and cost-effective method for preparing complete dentures or half jaw-3-D printed of 3-D printed Teeth using 3D printing technology. The loss of teeth or edentulism can lead to several problems such as difficulty in chewing, compromised aesthetics, and reduced self-esteem. Complete dentures and partial dentures have been used to restore the form and function of missing teeth. However, the conventional fabrication process of dentures can be time-consuming and often requires multiple appointments. Moreover, the conventional method is prone to errors, leading to discomfort and reduced patient satisfaction. With the advent of 3D printing technology, there has been a growing interest in using this technology to fabricate dentures. Therefore, the objective of this research is to develop a method for the preparation of complete dentures at once or half jaw-3-D printed of 3-D printed Teeth using 3D printing technology.

The first step in the proposed method is to produce a newborn child voice talk Mandible or edentulous impression. The impression material is used to create a negative replica of the Mandible, which is then used to produce a positive model. The positive model is then used to transfer the Mandible relationship.

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The next step is to acquire the digital model of the newborn child voice talk Mandible or edentulous Mandible and Mandible relationship. This can be done using intraoral scanners or cone-beam computed tomography (CBCT) scans. The digital model can be used to design the complete denture at once or half jaw-3-D printed of artificial tooth.

The preformation database will be used to design 3-D printed Teeth and its burnishing surface. The database will include information on the shape and size of teeth, as well as their arrangement. The occlusion will be adjusted to make the alveolar ridge supporting tissue undertake appropriate pressure distribution. This will be done using the virtual model of the denture.

The 3-D prototype of complete denture or half jaw-3-D printed of artificial tooth at once will be manufactured. This technology involves using a laser or other light source to cure a liquid resin, creating a solid object layer by layer. The resulting prototype will be checked for accuracy and fit before proceeding to the final manufacturing step.

The proposed method has several advantages over conventional methods of denture fabrication. The method is simple, and the production time is short. Moreover, the accuracy of the denture is high, leading to increased patient satisfaction. The use of 3D printing technology also reduces the production cost of dentures, making them more accessible to patients.

Research

The present research is a method for the complete denture restoration of an edentulous Mandible. The method involves several steps, including taking an impression of the edentulous Mandible and determining the Mandible relationship, obtaining a digital model of the edentulous Mandible and Mandible relationship, and designing the 3-D printed Teeth and base using Solidworks2012 software.

The first step involves taking an impression of the edentulous Mandible and determining the Mandible relationship. The measurement and establishment of horizontal relationship of establishment, vertical range including differential gap. The lower Mandible is taken without a Mandible stamp in three steps, determining the differential gap and establishing the vertical range and horizontal relationship.

In the second step, the upper and lower Mandible anodontia is fixed on a certain Mandible relationship and scanned using Upper and lower Mandible are scanned 3-D data with a certain Mandible relationship. This data is then used to create a digital model.

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In the third step, the 3-D printed Teeth and base are designed using Solidworks2012 software. The design process involves three steps, including designing the Mandible plane, designing the artificial tooth row's tooth.

Artificial tooth back teeth come differential gap. The design mandible posterior corresponding with the upper Mandible arranges tooth curve and Maxillary teeth arranges tooth curve.

The method described above represents a significant advancement in the field of dentistry, particularly in the restoration of edentulous mandibles with complete dentures. Edentulism, or the loss of all natural teeth, can greatly impact an individual's oral health, appearance, and overall quality of life. Traditional methods of fabricating complete dentures for edentulous mandibles have often been time-consuming and prone to inaccuracies. However, with the advent of 3D printing technology and precise measurements, this method offers a more precise and efficient solution for creating dentures.

The first step in this method involves precise measurements and modeling of the mandible relationship. This is crucial for achieving an accurate fit and optimal functionality of the dentures. Advanced imaging techniques, such as cone beam computed tomography (CBCT), can be utilized to obtain detailed 3D images of the mandible, allowing for a thorough assessment of the patient's specific anatomical features and jaw relationship. This data serves as the foundation for the subsequent stages of the denture fabrication process.

Utilizing specialized software, the 3D printed teeth and base are designed based on the collected data. The software enables the dental professional to customize the denture design according to the patient's specific needs and preferences. Factors such as tooth shape, size, and arrangement are carefully considered to ensure a natural and aesthetically pleasing result. The precise digital design allows for better control and accuracy compared to traditional manual methods.

Once the digital design is finalized, the 3D printing process begins. Advanced materials, such as biocompatible resins, are utilized to fabricate the denture components. The 3D printing technology enables the creation of highly detailed and customized dentures with improved accuracy and fit. The resulting dentures exhibit a high level of precision and can be tailored to the individual patient's unique oral anatomy.

One of the significant advantages of this method is the ability to provide accurate and comfortable dentures for patients. The precise measurements and digital design allow for better alignment with the patient's jaw, resulting in improved stability and reduced discomfort. The customized nature of the dentures ensures a better fit, enhancing the patient's ability to speak and chew comfortably. Moreover, the aesthetic appearance of the dentures can be finely tuned to match the patient's natural dentition, leading to increased confidence and improved self-esteem.

Overall, this method offers a transformative approach to restoring edentulous mandibles with complete dentures. By incorporating precise measurements, digital design, and 3D printing technology, it provides a more accurate and efficient solution compared to traditional methods. The ability to create customized dentures that fit precisely and comfortably has a profound impact on the patient's quality of life. It restores not only their ability to eat, speak, and smile but also their self-confidence and overall well-being.

The method described above is useful for restoring edentulous Mandibles with complete dentures. It involves precise measurements and modeling of the Mandible relationship and the use of software to design the 3-D printed Teeth and base. This method can provide accurate and comfortable dentures for patients, which can significantly improve their quality of life.

Conclusion

The 3D printing-based complete denture preparation method proposed in this research offers a number of advantages over traditional methods, including shorter production time, higher accuracy, and increased patient comfort. By utilizing digital models obtained from edentulous impressions or the newborn child voice talk Mandible, along with Mandible relationship transfer and reference to remaining teeth or anodontia form, this method enables the design and manufacture of 3-D printed Teeth that are customized to the individual patient's needs. With further development, this method has the potential to revolutionize the field of dentistry and improve the quality of life for millions of people suffering from tooth loss.

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