

Design Innovation of Ceramic Dental Model Moldwork through 3d Printing

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The study of ceramic dental molding models through three-dimensional printing technology aimed at studying the design of ceramic dental molding designs adapted through three-dimensional innovation as well as interpreting the innovative design of dental model molding materials through three-dimensional printing (3D Printing) and analysing the suitability of the results design of dental model molding materials through three-dimensional printing technology (3D Printing) based on design principles. This study uses a qualitative approach, using structured and non-structured observation and interview methods to analyse data and documents. Experimental studies of dental mold molding process procedures using conventional craft methods and three-dimensional printing technology methods were also conducted to obtain two comparisons of analytical data, namely conventional methods and three-dimensional printing technology. The findings show that the three-dimensional printing process of the same process and procedure is less complicated than conventional methods and the process of printing the tooth mold model takes time according to the quality of material selection for the printing process. This technology method still requires high technology skills to produce the design. Conventional methods of manufacturing procedure are very complex and require great detail and they require very high skill and experience for molding the model This study can also realise and apply to the dental industry and dentists to develop the technology method while optimising the conventional method so that it can grow more rapidly in the local market dentistry industry while the conventional method is still being used in conjunction with the three dimensional printing technology.

Key words: *Conventional, Ceramic Craft, Three-dimensional Technology Printing, Design, Revolution Innovation.*



Introduction

Innovation is a process of innovation in the cultural element of society that is technology. Innovation means discoveries in human technology. In other words, innovation can be defined as the ability to introduce new things or discoveries that are different from what is or is already known. Innovation is something that benefits and benefits the general public. In general, innovation is distinguished by innovations that occur accidentally (inventions) and innovations that occur accidentally (inventions). Inspired innovation is a form of problem solving for an issue. The emergence of technological innovation in the country's current development has been growing rapidly. At the same time, innovations in handicrafts have also experienced technological assimilation in the production of craft objects or goods produced through ergonomic design, pattern design and design. For other definitions, Innovation means something newly introduced including methods, systems, customs and more. In other words, it refers to methods or efforts to find ways to produce better products or services either through modification or refinement.

Dentists, and nurses have long practiced dental molding in terms of conventional ceramic craft in the field of dentistry and even these skills are required to produce the model. Thus, the dentist's model molded the idea of wanting to innovate in innovation through a three-dimensional printing technology to make it easier for doctors and nurses in the dental industry even to reveal the use of the technology. Therefore, this study will focus on " Design Innovation Of Ceramic Dental Model Moldwork Through 3D Printing ". This study will examine the methods of conventional ceramic craft materials as well as the application of three-dimensional printing technology for document/data analysis and design analysis. The researcher will also conduct an experimental study on the use of technology in the manufacture of dental mould.

Research Problem

The process of designing a ceramic mould for dentistry in the dental industry in Malaysia has grown rapidly. The manufacture of hand-crafted ceramic model molds requires hands-on skills and a high level of understanding of basic design principles to realise prototype results that meet the needs of consumers. However, there are problems in the manufacture of ceramic model molding for dentistry. Among the major concerns is poor quality ceramic model molding in terms of the correct size of the tooth model mold made using manual methods and requiring high individual handicraft skills. Additionally, conventional methods are practiced by hand-crafted practices by most model designers. Dental molding is no longer relevant since the long process of making the model for the model is often repeated due to the lack of hands-on experience in the manufacture of ceramic tooth mold models.

It lacks the latest technology optimisers in integrating hands-on skills for the manufacture of dental models into industrial designers. Therefore, this study is also a contributing factor to the innovation of ceramic denture molding moldings through three-dimensional printing. This study will look at the full range of materials, manufacturing processes, sizes and sizes for tooth model molding, as well as identify and explain the issues in this study. Therefore, the researcher will also strive to find the information and answers in this question necessary to produce a quality and practical research result. In this regard, this study will be able to address the issue of innovation in ceramic dentistry through 3D printing, which will enhance the image and creativity of the country's creative technology and creative industries.

Methodology

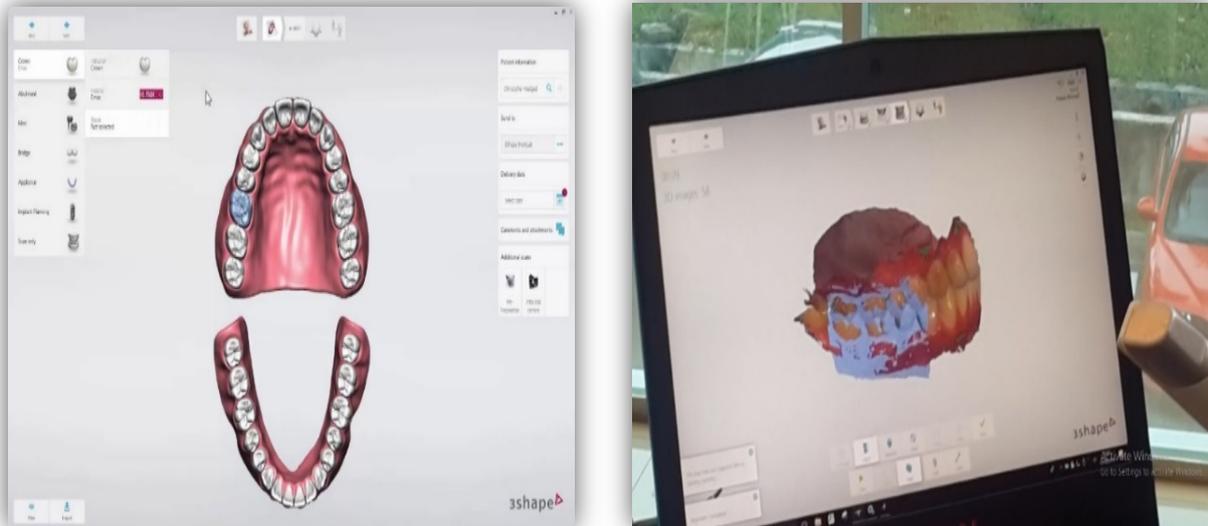
This study will use the qualitative approach with case study method through experimentation. Qualitative approach methods are used by the researcher in case studies capable of establishing the limitations of the various scopes of the study, response time, duration and location of the study which require more careful study of the work as well as a clearer response to the production of innovative handicraft design product innovation — model of ceramic teeth. The study design is an action plan that shows in detail the research carried out (sabitha, 2006). It also serves as a guide for assisting researchers in the process of collecting, analysing and interpreting the results of the researches conducted. The research design also serves as a model to enable researchers to infer the variables studied. For the innovative design of ceramic denture molding through three-dimensional printing technology. Therefore, for this study using a survey method that involves a qualitative approach. This survey method involves two main types of observation and interviews. The researcher will also conduct experimental studies through three-dimensional printing technology (3D Printing)

Findings

The analysis of studies carried out from experimentation, observation and interview using the qualitative method reported. The report began with respondents' interviews with dentists using conventional methods and three-dimensional printing technology to produce dental mold models around interview locations conducted in the Johor Bahru and Kuala Lumpur areas. The report began with respondents' interviews with dentists using conventional methods and three-dimensional printing technology to produce dental mold models around the locations of interviews conducted in the Johor Bahru and Kuala Lumpur areas. At the Universiti Pendidikan Sultan Idris, Tanjong Malim to collect data on the manufacturing process to produce the tooth. The findings of this study are about dental molding process procedure procedures and suggestions for replacing conventional materials with three-dimensional printing technology. The results of the research data that have been conducted from experimentation, observation and interview using the qualitative method reported.

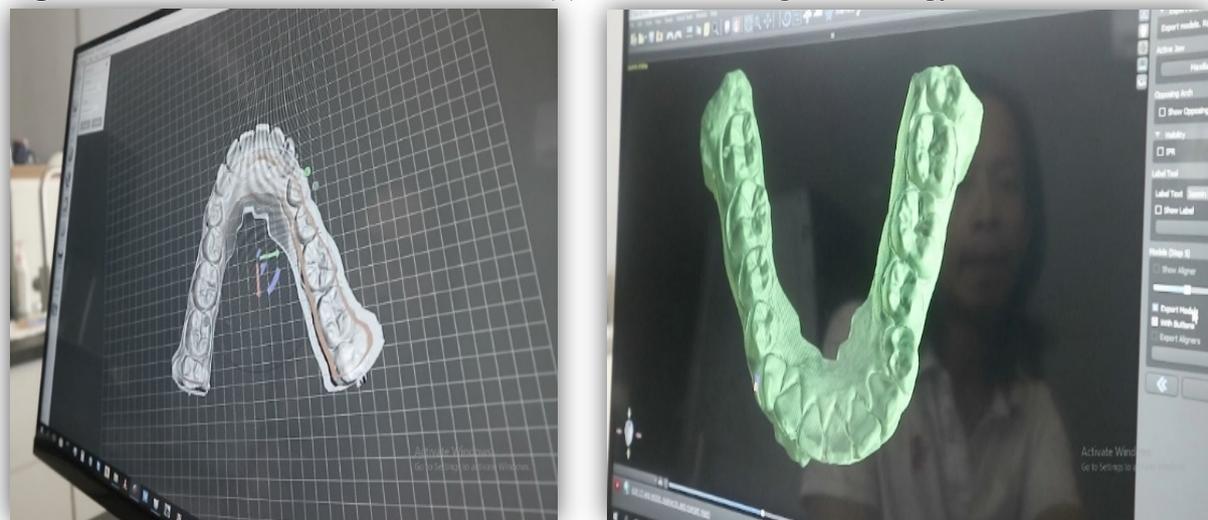
A) Three-Dimensional Printing Technology Procedures for Ceramic Dental Model Mold

Figure 4.1. Shows Procedure Procedures (1) For 3D Printing Technology



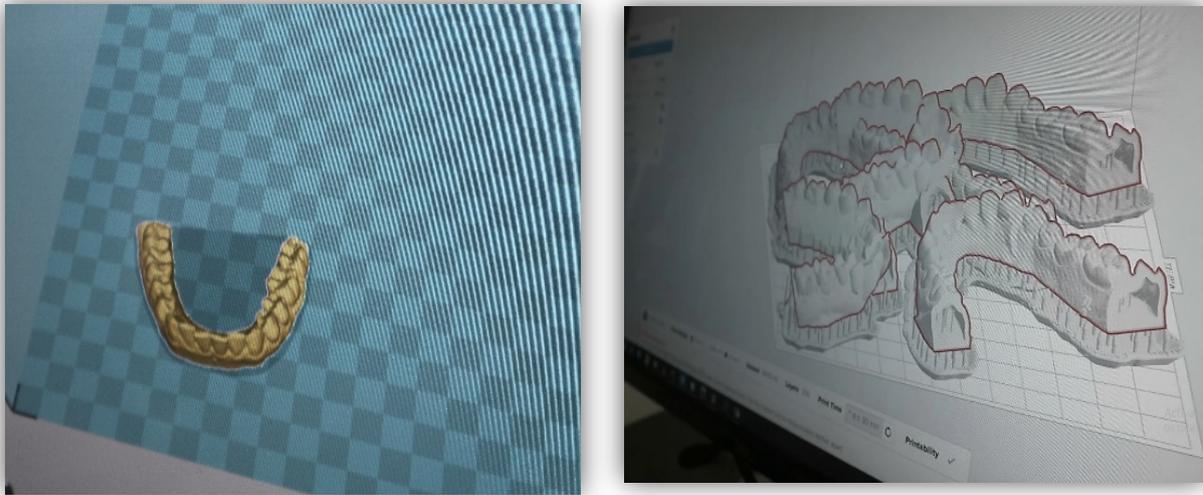
In the findings of the above diagram, for the first process procedure to produce a dental mold model using the technology method, we need to design the first through the "Intra Oral Scanner 3D" tool to scan into the mouth of the patient to convert the file to produce the next design for use with Autodesk Meshmixer Software or Autodesk 3D Max.

Figure 4.2. Shows Procedure Procedures (2) For 3D Printing Technology



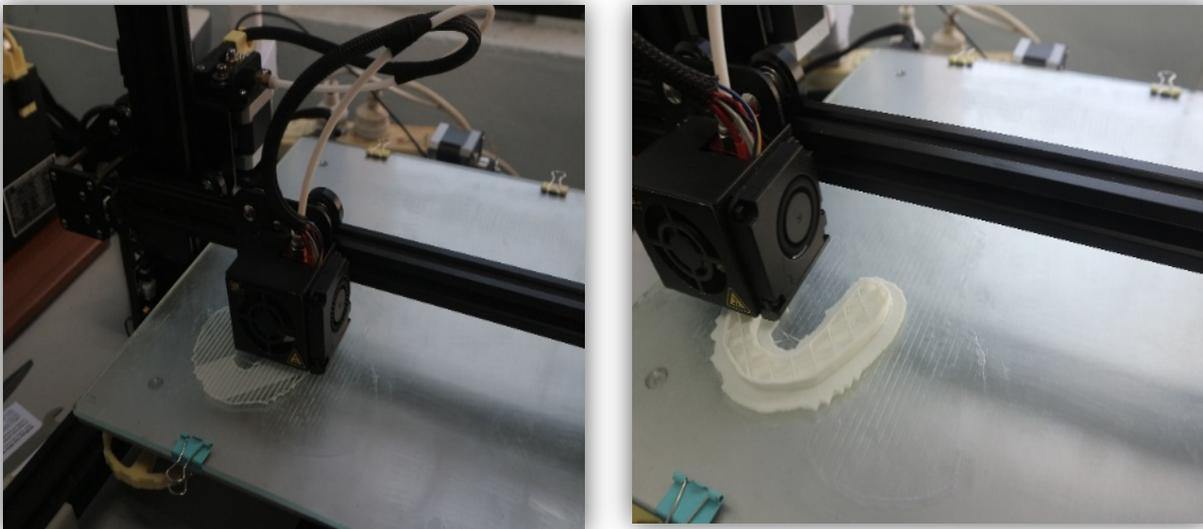
In the findings of the above diagram, for the second procedure to produce a dental mold model it is necessary to create, repair and fix the tooth model using Autodesk Meshmixer and Autodesk 3D Max software to make the tooth model more consistent and more accurate before the file transferred to a three-dimensional printing machine (3D Printing).

Figure 4.3 Shows Procedure Procedures (3) For 3D Printing Technology



In the findings of the above diagram, for the third procedure to produce a tooth mold model namely after repairing and designing a tooth model it should be transferred to 3D printing machine software while the 3D printing machine part should be set part time and so forth, while The machine needs to be adjusted using Polylactic Acid (PLA) material before beginning the process of printing the tooth mold model.

Figure 4.4. Shows Procedure Procedures (4) For 3D Printing Technology



In the study of the above diagram, for the fourth procedure of the tooth mold model is the process of printing 2 dental mold models for the top and bottom teeth model according to the quality level during the printing process in progress. For the printing process, for printing materials for a smooth level of 0.1, it takes 2 hours to print for 4 hours while for printing materials for non-smooth quality of 0.3 it takes 2 hours for 2 models only during the process

of printing the current tooth mold model according to the quality selection level of 3D printed materials for the top and bottom tooth models.

Figure 4.5. Shows Procedure Procedures (5) For 3D Printing Technology



The findings of the above diagram show the results of dental mold models that have used 3D Polylactic Acid (PLA) moldings after the process and manufacturing procedure of making tooth mold using three-dimensional printing technology (3D Printing). After observing and conducting this experimental study at Multimedia Studio, Universiti Pendidikan Sultan Idris, Tanjung Malim, Perak. The method of this technology still follows the same process and procedure as it is less complicated than the conventional method and the process of printing the tooth mold model takes only 2 or 4 hours according to the quality of material selection for the printing process.

Likewise, this technology also requires high technology skills to produce the design through the use of Autodesk Meshmixer and Autodesk 3D Max software to ensure before the process of printing two top and bottom tooth mold models so that the exact size and design of the model do not match. In conducting a research and observation study at the Klinik Pergigian Dr K, Ampang together with Dr Khairul Anwar and Nursing Assistants, he said they took time to develop the use of Autodesk Meshmixer and Autodesk 3D Max software in 5 months or a year, depending on one's skill set. The nurse assistant uses the software to create a dental mold model before moving on to a three-dimensional (3D Printing) process.

Conclusion

This study also provides an alternative to the design through the use of conventional handicraft materials through the use of 3D printing printing technology (3D Printing) so that it can facilitate the manufacture of dental mold design and denture molding which can serve as a



reference for physicians to make various treatments. Based on the findings of the study conducted in this chapter, the researcher has completed the field study, and all the questions have been answered to identify any concerns and suggestions for any research to be carried out and the researcher will document all the data collected and the researcher is working. Trying to realise the study can be used by the dental industry and dentist to develop the technology method while optimising the conventional method so that with this technology it can grow more rapidly in the local market dentistry industry while the conventional method is still used in conjunction with the three dimensional printing technology. It is hoped that this study will have a beneficial impact on industry designers, dentists and dentist design nurses who will feel the advent of discoveries in technology crafts. On the other hand, this study will contribute to the development of the craft industry towards the technology world in the future.

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REFERENCE

- Annie Warburton, Creative Director, Crafts Council, Innovation through Craft: Opportunities for Growth, pg 2
- Denizoglu S, Yanikoglu N, Baydas B. (2015). The Linear Setting Expansions of the Dental Stone and Whose Initial Setting Times.
- Daniel Michel, 2011, Google Vase diperolehi dari <https://daniel-michel.com/projects/products/google-vase/>
- Everett M. Rogers. (2003). New York Free Press : Diffusion of Innovations Theory Diffusion.
- Erkut Negis, 2009, A short history and applications of 3D Printing technologies in Turkey
- Gerlind Wisskirchen, Blandine Thibault Biacabe, Ulrich Bormann, Annemarie Muntz. (2017). IBA Global Employment Institute Artificial Intelligence and Robotics and Their Impact on the Workplace. Pg 9&10”
- Harozila Ramli, Tajul Shuhaizam, Mohamad NurHanif Hazman. 2019. The Beauty of Tritic Technique in Creating Batik-textile Pattern Designs. Journoul Of Advanced Research In Dynamical And Control System(JARDCS). Vol. 11, 05-Special Issue.
- Harozila Ramli, Tajul Shuhaizam, Mohamad Zaihidee Arshad. 2019. Symbolism of ‘Keleput’; Art and Intellectual Value of Penan Heritage Craft in Sarawak. Journoul Of Advanced Research In Dynamical And Control System(JARDCS). Vol. 11, 05-Special Issue.
- Harozila Ramli, Tajul Shuhaizam, Salwa Jamaldin, Mohamad NurHanif Hazman. 2019. The Impact of A Learning Module Based On Adobe Photoshop on The Teaching And Learning of Batik Pattern. International Journal Of Innovation , Creativity And Change. Vol.6 Issue 2.
- IG Okorji. (2009). Manaar Zuhurudeen. (2011). Ergonomics Introduction, Pg2
- Intan Khasumarlina Mohd Khalid, 2015, ‘Fusion’: Eksplorasi Bentuk Kraf Tembaga Melalui Integrasi Teknologi James Watt. Oxford Big Ideas Geography History 9 Australia Curriculum : Chapter 5 : The Revolution Industry. Pg 292



- Jeremy Rifkin. The Third Industrial Revolution: How the Internet, Green Electricity, and 3-D Printing are Ushering in a Sustainable Era of Distributed Capitalism. Pg 292, Pg 2 & Pg 5
- JR Kelly and P Benetti. (2010). Ceramic materials in dentistry: historical evolution and current practice. Pg 84-95
- Jeroen Junte, 2016, 3D-Printing And The Working Environment
- Katie Bunnell. 2004, Craft And Digital Technology, pg 7
- Ming C. Leu, Parthiban Delli and Mary P. Walker. (2008). Digital Design and Fabrication in Dentistry. Pg 125
- Mingchun Zhang And Ling Yang, 2017, Ceramic Product Forming Technologies Research Based on 3D Printing
- Nanyoung Kim. (2014). 9:Conceptual , Biological And Historical Analyses Of Craft . Pg 62
- Plymouth College Of Art, 2013, Making Futures : Interfaces Between Craft Knowledge And Design: New Opportunities For Social Innovation And Sustainable Practice, pg 59
- Raymond R. Tjandrawinata. (2016). Industri 4.0: Revolusi Industri Abad Ini dan Pengaruhnya pada Bidang Kesehatan dan Bioteknologi, pg 32 - 39
- Stephen Hoskins, 3D Printing for Artists, Designers and Makers, pg 64
- Teori Difusi Inovasi Konsep dan Perkembangannya, Diperolehi dari <http://www.majalahsains.com/revolusi-industri-ke-4-mampukah-menginsankan-teknologi>
- U.S. Department of Labor Occupational Safety and Health Administration. (2000). Ergonomics : The Study of Work, Pg2
- William R. Miller. (2005). Trimtab, Buckminster Fuller Institute, Definition Of Design
- Katie Bunnell. 2004, Craft And Digital Technology, pg 7