Use of Virtual Articulator in Prosthodontics

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Use of Virtual Articulator in Prosthodontics

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Abstract. While the mechanical articulators have contributed to enhanced design, manufacture, and fixing of artificial replacements for different mouth components, virtual articulators are being considered as a viable replacement which not only carry out these obligations in a more advanced manner, but they also offer considerable outcomes. To begin with, reproduction of exact movement of trails of the mandible employing an automated jaw process structure referred to as jaw motion analyzer (JMA) makes it unique. Furthermore, dental arches are not only easily viewed on a screen, but also their movements can be studied for efficient reproduction. Some challenges that it solves include the problem of poorly manufactured, designed, and fitted artificial mouth-parts replacements (Pandita, Dod, & Bhat, 2016). Primary and secondary data are to be collected. The study design will entail identifying secondary sources that qualify in the category of quantitative studies and on the adoption of virtual articulators in prosthodontics. In addition to this approach, the use of interviews will also be carried out as another research technique. The method will entail questioning dentists and orthodontists that use virtual articulators to highlight and investigate the benefits of this technology.

Key words: Prosthodontics, virtual articulators, dentures, digital dentistry, artificial teeth, virtual reality

1. Introduction

While there are different ways in which technology is bolstering the quality of life on many dimensions, the field of dentistry through prosthodontics continues to adopt trends that are not only improving the quality of life but medical practices as well. In this given study, however, attention is on the role of virtual articulators in prosthetic as well as restorative dentistry. The operational dynamics of virtual articulators is based on the concept of virtual reality, and its effectiveness can be explained as an advanced step towards dental practice with approaches susceptible to improvements offered by technology. Defined as immersive, as well as multi-sensory, they are also viewer-centered and interactive. In addition to its three-dimensional features, virtual reality allows the generation of computer environments which can be manipulated and customized to serve various purposes. Through enhanced navigation and view of the world through the all the available degrees of autonomy, the use of virtual articulators in prosthodontics is not only fast-rising in western nations, but it is presenting an alternative that the oral features of people can be enhanced as well as be corrected (Thumati, 2014). Considering that the environment within one's mouth can be easily cloned; it follows that replacements (which is possible through prosthodontics) can be easily installed as perfect replicas of the real environment. In other terms, there is increased interaction with virtual reality with equipment such as virtual articulators making them technological inventions that are ground-breaking in contributing to dental health and hygiene (Koralakunte, & Aljanakh, 2014). A contribution that they have to the arena of prosthetic also understood as restorative dentistry (which encompasses prosthodontics) is incorporation of concepts of virtual reality to clinical dental practices. While the mechanical articulators have contributed to enhanced design, manufacture, and fixing of artificial replacements for different mouth components, virtual articulators are being considered as a viable replacement which not only carry out these obligations in a more advanced manner, but they also offer considerable outcomes.

2. Literature Review

The chief application of virtual articulators is aided by the 3D representation of the jaw that is based on real-time patient data. Thus, characteristics such as jaw movement are considered, which initially (with mechanical articulators) was not possible, making it a viable alternative in prosthodontics. Among the many associated benefits with this invention, there is the possibility of simulating jaw movements so that enhanced visualization of occlusal contacts can be attained (Bhayana, Atreja, Atreja, Juneja, & Kumar, 2015). Referred to as software able to achieve improved clinical outcomes founded on computer-generated realism, there are many ways through which prosthodontics through the field of dentistry can benefit (Kar et al., 2019). To begin with, reproduction of exact movement of trails of the mandible employing an automated jaw process structure referred to as jaw motion analyzer (JMA) makes it unique. Furthermore, dental arches are not only easily viewed on a screen, but also their movements can be studied for efficient reproduction. With an ability to calculate as well as visualize both kinematic and static occlusal collisions, virtual articulators' operational dynamics with it's a uniquely designed software allows the design and rectification of occlusal outsides which are the primary objectives of prosthodontics hence the strong interrelation (Park, 2017). Most dental clinics, based in the western part of the world, are adopting the standard virtual articulator such as DentCam and the four main features include the rendering window, slice window, occlusion window, as well as smaller window (Raja'a, & Farid, 2016). Each of these components has a different responsibility, and they can all be based on an orthodontic module that would substantially benefit the practice of prosthodontics. There are many ways through which this virtual reality tool can be applied to the field of dentistry, and in this study these alternatives are investigated and stated. By undertaking progressive research that lasts for two years. Qualitative data will not only be collected, but it is to be assessed to compare outcomes and functionality between the virtual and mechanical articulators. In doing so, it offers a means through which virtual articulators can be proposed as the best option for use in prosthodontics.

3. Problem Statement

Defined as the branch of dentistry concerned with the design, manufacture, and fitting of artificial replacements for teeth and other parts of the mouth, greatly enhance clinical outcomes for dentists in their undertakings; prosthodontics stands to benefit from the use of virtual articulators. Some of the challenges that it solves include the problem of poorly manufactured, designed, and fitted artificial mouth-parts replacements (Pandita, Dod, & Bhat, 2016). If the virtual articulators are to be adopted, they would be replacing mechanical ones, and as a result, a series of issues will be solved. For example, there is the problem of the deformation of bite registration material. Such a problem presents patients with the challenge of the problem of biting as the wax that is used alongside the mechanical articulators is susceptible to heat changes (Sabalic & Schoener, 2017). Thus, the wax must be placed appropriately in the process of repositioning, and virtual reality allows a more advanced view of all the angles of the moth during the process. Moreover, there is the challenge of adequately repositioning the cast into the bite impressions. The problem that arises is space being left, and this leads to further dental issues. Most importantly, as Thumati (2014) notes, the artificial replacement needs to be stable to serve the given purpose in the mouth, and mechanical articulators are unable to fit them firmly. Lastly, there are issues relating to incorrect orientation and use of rigid plaster that is poor with mechanical articulators (Luthra et al., 2015). Virtual articulators offer a solution to all these issues in that they allow rigid placement, and there is a high level of accuracy when designing, manufacturing, and fitting.

4. Research Aim and Hypothesis

The aim of this research is to find out to identify the features of the virtual articulator and to ascertain the challenges and benefits associated with the use of virtual articulator in prosthodontics as a technologically relevant technique. The solutions that virtual articulators present to the challenges associated with the use of mechanical articulators will be brought to light. We will explore the difference of the static and dynamic occlusal contacts sliding over the surfaces of the upper and lower jaw as a function of time. The goal is to compare static and occlusal contacts between the dentures through the usage of two types of articulators. With increased usage of virtual articulators, prosthodontics is more likely to design, manufacture, and fit artificial mouth parts replacements in a more effective manner which means that clinical outcomes are greatly bolstered.

5. Methodology

Primary and secondary data are to be collected. The study design will entail identifying secondary sources that qualify in the category of quantitative studies and on the adoption of virtual articulators in prosthodontics. The research will last for two years, during which time different publications on trends of virtual articulators will be assessed to track the development of this new technology and its use in Prosthodontics. By focusing on secondary sources that embrace quantitative research methods, re-analysis will entail evaluation of statistical data, and in doing so findings and assertions that are presented will give numbers on trends of adoption of virtual articulators. In addition to this approach, the use of interviews will also be carried out as another research technique. The method will entail questioning dentists and orthodontists that use virtual articulators to highlight and investigate the benefits of this technology. The number of dentists that are using the technology will be compared to the patients that have benefited allowing numerical comparisons of the success rate of design, manufacture, and fittings. The interviews will include a total of 100 participants, with 25-30 of them being dentists and 70-75 patients who have benefited from artificial replacements.

5.1 Sampling, Data Collection Methods and Data Analysis

As noted, primary data constitutes the research design to be used, and a total of 100 participants will be included in the study, and they will accommodate dentists and patients of all age groups. As a secondary data we will use at least 50 sources for the last 5 years. Primary data will be collected with questionnaire developed for dentist and for patients, separately. Secondary data collection is through document analysis is that the studies and research by other researchers are evaluated for further evaluation. Collected data is recorded with instruments such as notebooks and electronic sources such as computers for the feedback from the interviews. Content analysis and narrative analysis are to be used as data analysis techniques. Upon carrying out document analysis, the data that will be captured will be subjected to scrutiny based on the research questions and objectives. The same approaches will be used for the data collected from the interviews.

Conclusion

With an ability to calculate as well as visualize both kinematic and static occlusal collisions, virtual articulators' operational dynamics with it's a uniquely designed software allows the design and rectification of occlusal outsides which are the primary objectives of prosthodontics hence the strong interrelation (Park, 2017). If the virtual articulators are to be adopted, they would be replacing mechanical ones, and as a result, a series of issues will be solved.

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