SURVEYING IN REMOVABLE PARTIAL DENTURES: FROM ANALOG TO DIGITAL

Delineamento em próteses parciais removíveis: do analógico ao digital

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RESUMO

O fluxo digital na odontologia vem se tornando cada vez mais presente e acessível aos profissionais e aos pacientes. Em prótese parcial removível, o planejamento requer uma etapa indispensável, que é o delineamento, momento

em que se transfere as informações da boca do paciente para o modelo e que é identificada a necessidade de adequação do meio bucal, com a finalidade de estabelecer os planos guias, eixos de inserção, oferecer estabilidade, retenção da prótese e conforto para o paciente. Com a tecnologia presente, hoje há a possibilidade de realizar esse passo de forma digital, que já se revelou com bons resultados e boa precisão em relação ao método convencional. Essa nova maneira de planejar as próteses parciais removíveis proporciona um menor tempo clínico, maior conforto ao paciente e resultados com excelente adaptação das próteses, sendo um diferencial aos pacientes que não podem realizar outros tipos de tratamentos reabilitadores. Sendo assim, o presente trabalho teve como objetivo, descrever esses dois diferentes métodos para execução desta etapa, o digital e o analógico (convencional), pontuando suas vantagens e desvantagens. Para esse fim, foi feita uma revisão de literatura, com pesquisas nas bases de dados científicas, selecionando artigos e trabalhos acadêmicos, além da leitura de livros físicos e digitais, com intuito de analisá-los e compará-los, reunindo as informações pertinentes ao objetivo desta pesquisa.

Palavras-chave: fluxo digital; delineamento; prótese parcial removível.

ABSTRACT

Digital workflow in dentistry is becoming increasingly present and accessible to professionals and patients. In removable partial dentures, planning requires an essential step: the surveying process. This step transfers information from the patient's mouth to the model and identifies the need for oral adjustments to establish guiding planes, insertion paths, stability, prosthetic retention, and patient comfort. With current technology, this step can now be performed digitally, yielding promising results and high precision compared to conventional methods. This new approach to planning removable partial dentures reduces clinical time, enhances patient comfort, and results in prostheses with excellent adaptation, making it a valuable alternative for patients who cannot undergo other types of rehabilitative treatments. Therefore, this study aims to describe two different methods for performing this step—digital and analog (conventional)—highlighting their advantages and disadvantages. To achieve this, a literature review was conducted by searching scientific databases for articles and academic studies, as well as consulting physical and digital books, with the goal of analyzing and comparing them to gather relevant information for this research.

Keywords: digital workflow; surveying; removable partial denture.

INTRODUCTION

Rehabilitations with removable partial dentures (RPDs) are widely used in modern dentistry. Given the aging population and the continued occurrence of tooth loss, albeit at lower rates, the demand for RPDs is expected to persist (GALVÃO et al., 2021). Furthermore, despite the advent of implant treatments, not all cases can be resolved using this technique due to mechanical, psychological, biological, or financial limitations, such as systemic health conditions, insufficient bone availability, or socioeconomic constraints that prevent access to costly treatments (SUGIO et al., 2019). Consequently, oral rehabilitation with RPDs will continue to be relevant in the near future, even as new techniques emerge in dentistry.

The success of this prosthetic treatment is directly linked to proper planning, which includes diagnosing the need for oral adjustments, surveying, and designing the prosthesis for the specific clinical case. The surveying phase of the study model is fundamental to the success of the treatment. At this stage, the need for compensatory reductions or additions is detected to create guiding planes and define the insertion and removal paths of the prosthesis, ensuring stability, retention, and patient comfort. Unfortunately, this step is often neglected by many dentists, who send their models to the prosthetic laboratory without proper surveying and case planning. This results in poorly designed prostheses that hinder patient adaptation and may even lead to treatment rejection (ZAVANELLI, 2016).

Due to inadequate planning, the prosthesis may fail to restore both function and esthetics. Moreover, prolonged use of an improperly designed prosthesis can cause complications such as hyperplasia, traumatic ulcers, and candidiasis (SILVA, 2022).

It is essential for dentists to incorporate this step into their RPD fabrication protocol to increase the success rate of oral rehabilitations that use this type of prosthesis (CURINGA, 2022). With the advent of digital dentistry, various methods for surveying study models are now available, including both analog and digital techniques using specialized software (BLUMER, 2023).
Digital surveying is an effective way to integrate technology into RPD planning at a lower cost. This makes the digital workflow more accessible and provides significant benefits to both dentists and patients (SANTANA, 2022). Additionally, some analog techniques can be integrated into this workflow, allowing for application in universities and clinics that lack digital equipment, such as intraoral scanners.

METHODOLOGY

This study is a literature review. Articles were searched in databases including PubMed, BVS, ScienceDirect, SciELO, ResearchGate, and Google Scholar. The research was conducted in January and February 2024 using the following keywords: removable partial denture, dental implantation, intraoral scanning, dental scanner, digital virtual model, surveyors, surveying, digital workflow, removable partial denture, conventional impression, scanning. Filters were applied to include studies in English and Portuguese, published within the last ten years, and with abstracts available for analysis.

OBJECTIVES

To clarify how digital workflow can currently be applied in the surveying stage of removable partial dentures, not only by professionals but also by undergraduate dental students.

DISCUSSION

For effective surveying, a high-quality study model is required to ensure an accurate copy for case analysis and planning. This step can be fully digital, using intraoral scanning, or a combination of analog and digital approaches, where bench scanners digitize conventional impressions. The advantage of using traditional impressions with hydrocolloids or elastomers is that it is a familiar practice for dentists and does not require an intraoral scanner. However, the additional steps involved in this approach may increase the likelihood of errors. When using the intraoral scanning technique, this transfer process to the software is reduced to just one step, minimizing the likelihood of errors. Nonetheless, the need for an accurate reproduction of the soft tissues poses a challenge due to the minimal texture differences and the high resilience of the oral mucosa, making it difficult for the scanner to accurately capture these edentulous areas, which are regions of utmost importance in the model. In some cases, gingival barriers are used to create texture variations and enhance scanning accuracy. Additionally, shadow areas caused by adjacent teeth may hinder direct light exposure, particularly in cases with elongated teeth due to bone loss. When scanning these shadowed regions proves difficult, clinicians often opt for conventional impressions followed by bench scanning to avoid errors in the digital model (BLUMER, 2023).

Regarding working time, while the analog method does not take significantly longer, it requires more steps than the digital method. In analog surveying, the model must be manually positioned, analyzed with different tips, and each abutment tooth must be individually traced (ZAVANELLI, 2016). In digital surveying, all these steps are completed almost instantaneously by adjusting numerical values, and the software quickly generates the necessary information (BLUMER, 2023).

Another advantage of digital surveying is the secure and efficient storage and sharing of data. Unlike physical models, which require careful transportation and are at risk of contamination or structural damage, digital files can be instantly sent to the laboratory, reducing risks associated with model handling (SILVA, 2022). Furthermore, digital planning allows dentists to reevaluate designs, maintain legal records, facilitate communication with technicians, and visually explain treatment plans to patients. The software also aids in predicting necessary oral modifications, optimizing chairside time, and enhancing patient safety and comfort (BLUMER, 2023).

Regarding accuracy, the digital method has demonstrated good precision compared to the analog method, with both being effective. However, digital surveying offers a notable advantage: color-coded visualization of retentive areas based on their degree of retention. This feature simplifies and accelerates the evaluation of abutment teeth and the oral cavity, helping diagnose the need for tooth preparation or soft tissue adjustments (CURINGA, 2022).

A limitation of digital surveying is the inability to automatically transfer information about oral modifications. When adjustments are needed for retention and stability, these must be performed conventionally and then digitized. The system cannot determine the exact amount of modification required, though it can indicate where adjustments should be made (BLUMER, 2023).

Figures 1 and 2: Three-point technique to define the path of insertion and removal, using utility wax to replace the tooth loss in the edentulous area.
Source: Own authorship

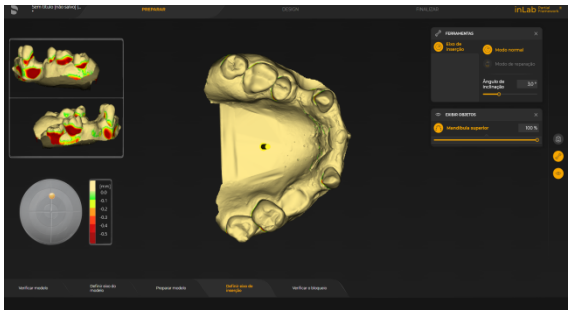

Figure 3: Trial method observing the retention color scale - inLab Software
Source: Own authorship

One disadvantage of analog methods compared to digital ones is the limited availability of planning tools. Digital software offers numerous resources for better visualization of treatment plans, such as predicting the position of artificial teeth, identifying ideal locations for metal framework components, and determining relief areas for improved prosthetic adaptation. In contrast, traditional techniques do not allow for the creation of predictive models or the anticipation of potential errors and inaccuracies (BLUMER, 2023).

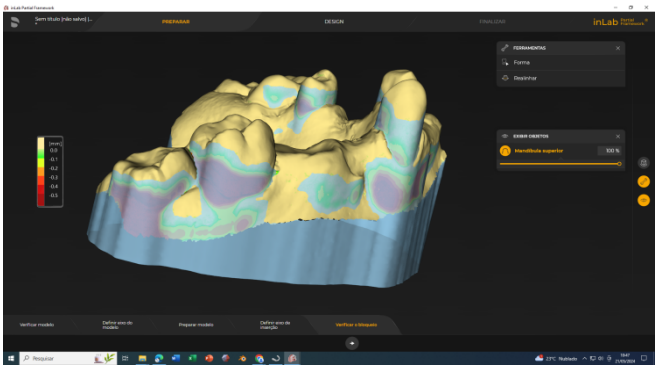

Figure 4: Relief of the model's retention zones, with a blue color pattern - inLab Software
Source: Own authorship

Regarding cost differences, it is important to note that they can vary. If the dentist does not own a scanner, digital surveying will be slightly more expensive than conventional methods, as the professional must pay a laboratory to scan the gypsum model for each planning process. However, traditional surveyors, plates, and accessory tips are reusable, representing a one-time cost without additional expenses per treatment. Nevertheless, incorporating digital workflow in RPD planning remains cost-effective, as scanning costs are relatively low and offer a high cost-benefit ratio. If the dentist has access to a scanner, digital surveying becomes more advantageous, eliminating material expenses and making the process entirely software-based (SANTANA, 2022).

Additionally, digital techniques allow patients to visualize the projected outcome before treatment begins. Unlike analog methods, which rely on gypsum models that are harder to interpret, digital planning enhances communication by showing before-and-after simulations, helping patients understand the treatment plan (BLUMER, 2023).

CONCLUSION

Both analog and digital surveying techniques yield excellent results and are essential for the optimal planning of removable partial dentures (RPDs). This is a quick procedure with a straightforward step-by-step approach, once the correct protocols are understood, and should not be overlooked by professionals, as it provides critical information for successful RPD planning.

The digital method has demonstrated significant advantages over the traditional approach, particularly in terms of ease of information sharing, speed, and patient comfort. Moreover, it serves as a more accessible way to integrate digital workflows into the prosthesis fabrication process, as it does not require costly

equipment, such as an intraoral scanner. Thus, virtual surveying can even be incorporated into university curricula.

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