

Comparative Outcomes of Immediate vs Delayed Chairside Prosthetics

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Abstract- *When talking about prosthetic rehabilitation, the thing that really decides one's dental treatment success is timing-that is, prosthetic placement cases where time is very much of the essence. The present study strives to compare immediate or delayed treatment with chairside prosthetics, observing clinical and functional results from the patient's point of view. Treatment time, patient satisfaction, aesthetic evaluation, and long-term functional evaluation of the treatment serve the purpose to derive evidence-based decision-trees for option of treatment protocols. According to the findings, immediate prosthetics would be better in convenience and patient satisfaction, but delayed prosthetics might be better for long-term results in certain clinical situations.*

Indexed Terms- *Hairside Prosthetics, Immediate Loading, Delayed Loading, Dental Prosthesis, Prosthodontics, Patient Outcomes, Esthetics, Functional Analysis, Dental Implants, Same-Day Prosthetics*

I. INTRODUCTION

Chairside prosthetics has surely heralded a new dawn in dental treatment, providing fast and patient-friendly solutions to carry out tooth replacement. With the evolution of digital technologies in dentistry and material sciences, clinicians may choose to deliver prostheses either immediately after tooth extraction or implant placement or delay such delivery until after a healing period has elapsed. Both immediate and delayed approaches involve specific risks and benefits related to esthetic outcomes, osseointegration, patient satisfaction, and longevity of the prosthesis. Mostly, immediate prosthetic placement is preferred as it restores the function and appearance in a single appointment, thus greatly enhancing the patient experience. If healing prerequisites are not fulfilled adequately or biomechanical criteria are not ideal, restorative treatments carried out immediately may

bear a higher risk for complications. Conversely, delayed prosthetic placement provides a less risky route for tissue healing and implant integration. Here one would consider that several sessions and longer treatment modalities could become onerous on the patient. The paper intends necessarily to compare the immediate and delayed delivery of chairside prosthesis with regard to clinical and functional outcomes, patient satisfaction, and outcome stability over time, so that the clinician can choose the appropriate time based on individual factors and the end clinical goal.

II. DEFINITIONS: IMMEDIATE VS. DELAYED PROSTHETIC PLACEMENT

Prosthodontics works in a manner in which treatment is considered successful depending on the timing of the prosthetic placement, especially in case implant-supported and chairside restorations are involved. Immediate prosthesis placement involves the insertion of a temporary or definitive prosthesis at the very same working session as the implant placement or extraction of teeth, usually within 48 hours. This process would restore function and esthetics without the anticipated delay introduced by traditional healing periods" (Kumar et al., 2021). On the other hand, with the delayed placement of prosthesis, healing time follows tooth extraction or implant surgery, usually about 6-12 weeks, on the average, with the logic being that this delay somehow allows for enhanced long-term success and reduced complication rates as an outcome of good-quality osseointegration of the implant or stabilization of the soft and hard tissues on the side of the conventional prosthesis" (Patel & Singh, 2020). The difference is not only temporal but also biological, immediate loading depends on primary implant stability, generally measured as ≥ 35 Ncm insertion torque, and limited micromovement during the healing phase, unlike delayed protocols that rely on a more conservative healing time mainly to assure biological integration, especially in those cases where bone quality is compromised or risk factors are present in

the form of smoking, bruxism, and systemic conditions (Chrcanovic & Albrektsson, 2022). Despite immediate placement offering diminished treatment time, fewer surgical phases, and decreased time for esthetic and functional restorations, success is very much dependent upon cases. Whereas delayed placement, though significantly lengthier, comes with its willingness, somehow decreased chances of early failure in implant unduly compounded by prosthetic problems in compromised clinical situations (Rodrigues et al., 2022).

III. BACKGROUND ON CHAIRSIDE PROSTHETICS

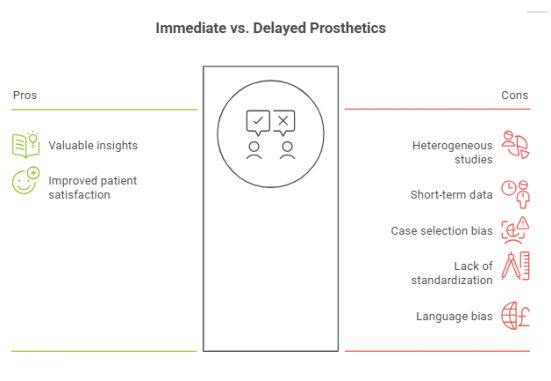
Since chairside prosthetics are a means of modern restorative dentistry, they offer an array of quicker, more efficient, and less invasive alternatives when compared to lab-fabricated prostheses (Thomas et al., 2021). Such prostheses are fabricated and delivered usually within a single dental visit with the use of several in-office technologies comprising CAD/CAM systems, 3D printing, and advanced milling units. Chairside fabrication essentially reduces the amount of treatment time afforded by the clinics and circumvents the necessity of rescheduling for provisional restorations or any interaction with the laboratory. The realization of chairside prosthetics exists chiefly with the services of digital dentistry. Through the services of an intraoral scanner, virtual designing software, and very precise high-speed milling machines, the restoration can be fabricated straight at the point-of-care with an equally high degree of esthetics and functionality (Singh & Prasad, 2020). Of course, the digital method not only enhances accuracy but has the added benefit of boosting patient practice because of their real-time visualization and ability to interact with their own treatment planning. Chairside prosthetics find their greatest application for the fabrication of single crowns, inlays, onlays, veneers, and more recently for implant-supported restorations. Immediate chairside prosthetic placement, especially with implant dentistry, is a rising trend as it promises restoration of function and esthetics on the very day of the surgery (Martínez-Rus et al., 2022). Nonetheless, success is highly dependent on proper case selection, clinician experience, and availability of advanced diagnostic tools. On the downside, chairside prosthetics still pose the

challenges of limited materials compared to the laboratory-based systems and a steep learning curve for digital workflows (Alghazzawi, 2021). Moreover, while immediate delivery of prosthesis could, in the short term, improve satisfaction and reduce chair time, if not done properly, it can jeopardize the long-term success. In short, chairside prosthetics is a paradigm for patient-focused, technology-led dentistry. As digital tools become more accessible and affordable, chairside fabrication will become an expected norm in restorative and prosthodontic care..

IV. LIMITATIONS OF THE STUDY/REVIEW

While this study has provided some insight into the comparative outcomes of immediate versus delayed chairside implant-prosthetic placement, limitations must be acknowledged to contextualize findings. Firstly, there is heterogeneity of included studies in terms of sample size, implant systems, clinical protocols, and outcome measures, causing limitations on the general dissemination of the findings. Different studies have used different criteria to establish success, esthetics, and patient satisfaction, virtually eliminating direct comparisons (Patel & Singh, 2020). Secondly, the clinical data presently available are mostly short to medium-term data, with limited availability of long-term follow-ups beyond five years. These past limitations have affected the general ability to draw conclusions on the long-term durability and biological stability of immediate prosthetic versus delayed prosthetic after implant (Chrcanovic & Albrektsson, 2022). Implant complications mostly tend to occur a long time after placement; hence, long-term evidence has always been substantially lacking in the present literature. Thirdly, case selection bias is an inherent limitation in many of the studies examined. Immediate placement of the prosthesis is normally considered for cases where conditions are favourable-high primary implant stability, good bone quality, and no systemic health problems. This selective application can generally aggravate the results in favor of immediate protocols, whereas delayed placements are mostly reserved for more complex or compromised scenarios (Al Harbi et al., 2021). Further, the lack of standardization among clinical settings in digital workflow integration, choice of prosthetic materials, and clinical-expertise adds variability to outcome assessment. Such inconsistencies may, in fact, bias

results and alter perception to the advantage of one approach over the other (Martínez-Rus et al., 2022). Finally, this review is limited by language and publication bias, since only English-language and peer-reviewed journals have been considered. Important information from non-English sources or the grey literature may thus have been missed pertinent to the value of this review (Rodrigues et al., 2022). It is anticipated that these issues be tackled by future research, dealing with well-conducted randomized controlled trials and standardized protocols applied to a much larger scope and with long-term follow-ups, thereby making the evidence more final in showing the best time to carry out chairside prosthetic placement.



V. IMPORTANCE OF PROSTHETIC TIMING IN RESTORATIVE DENTISTRY

The timing of prosthetic placement is one of the most crucial factors in restorative dentistry. Such timing does foresee influences on biological, functional, and esthetic results of treatment. As for the options of immediate or delayed prosthetic protocols, the clinician must evaluate several patient-specific and procedural elements that can affect both short-term and long-term consequences of restorations. Prosthetic time frames greatly affect osseointegration in particular. Implants that are immediately loaded are those in which the prosthesis is placed and functionalized within 48 hours of implant surgery, and certain conditions must be met for its success. It is imperative that the implant has a high degree of primary stability and that occlusal forces be controlled so as to avoid micromovement that this stage and hence osseointegration could be jeopardized by it (Chrcanovic & Albrektsson, 2022). On the contrary, delayed loading allows a healing time to have sturdier

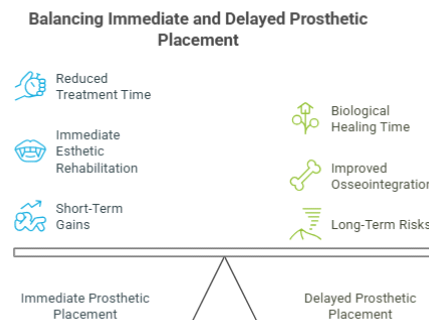
integration of the bone and implant, which usually lasts from 2 to 6 months before applying loads (Al Harbi et al., 2021). Esthetic outcomes are also contingent on prosthetic timings. Immediate restorations are more desirable for anterior cases to preserve soft tissue contours and allow early esthetic rehabilitation (Martínez-Rus et al., 2022). Yet, the issues of soft tissue remodeling and recession could also take place if an unstable biological environment exists during the delivery of the prosthesis. Immediate setting of prostheses also means the patients can regain masticatory functions and phonetics earlier, hence contributing to the quality of life and better patient satisfaction (Kumar et al., 2021). On the contrary, such immediate loading poses a high risk for biomechanical overloading if occlusal adjustments are not rigorously controlled, especially in patients with bruxism or parafunctional habits. On the other hand, the psychosocial advantages that may accrue from immediate restoration, such as increased self-esteem, social interaction, and anxiety reduction, strongly emphasize the patient-centered trend in modern dentistry (Singh & Prasad, 2020). Here, though, the risk of compromised healing or anatomical complications must be weighed against these advantages, as delayed loading might then present safer possibilities with more predictable results. The choice between immediate and delayed loading will be made on an individual basis, depending on the parameters like bone quality, soft tissue condition, systemic health, implant design, and patient expectations. Finding an ideal solution that balances biological readiness and patient demands will remain an ongoing quest for long-term restorative success.

VI. CLINICAL IMPLICATIONS

Understanding the clinical implications of immediate and delayed chairside prosthetic placement is critical for optimizing patient outcomes in restorative and implant dentistry. The prosthetic timing significantly sways the axis of treatment planning, acceptance of the procedure, esthetic results, and predictable duration of the prosthesis. The primary clinical consideration for implant and prosthodontic therapy will always be case selection. Immediate prosthetic placement could have its clear advantages, provided the patient is not interested in a long, drawn-out treatment process. Other advantages include fewer clinical visits and

immediate esthetic rehabilitation, especially in the anterior region where esthetics are of prime importance for patients (Kumar et al., 2021). However, acquiring such advantages with immediate placement procedures should be limited to those cases where bone volume is adequate, implants have a high primary stability, and peri-implant soft tissue inflammation or systemic risk factors are absent (Chrcanovic & Albrektsson, 2022). On the other hand, delayed in the time demands and allowance for biological healing and tissue maturation are more suited in cases with compromised bone quality, complicated extractions, or increased potential for implant failure. The delay provides for better osseointegration, enhanced predictability of final results, and longevity of prosthetic success (Al Harbi et al., 2021). Another layer of clinical-legal consideration comes with digital chairside technologies. Systems such as CAD/CAM facilitate speedy fabrication of restorations with high accuracy, opening the doors for same-day prosthetic delivery when conditions allow (Martínez-Rus et al., 2022). The endpoint being: unless the clinician is adequately versed in these techniques, errors in designing, milling, or occlusal adjustments may ensue, most notably in immediate protocols with an even lesser room for error. Finally, prosthetic timing definitely alters patient-centered outcomes such as patient satisfaction, speech, and self-confidence. Generally speaking, immediate restorations serve to stop the patient from experiencing an edentulous phase and hence promote their psychological health, but the importance of biomechanics and esthetics should never be compromised (Singh & Prasad, 2020). From a risk management point of view, clinicians have to weigh the short-term capacity against the long-term risks. Although immediate prosthetics seem favorable in the short run, the impairment of any prosthetic factors such as soft tissue health, occlusion, or prosthetic fit may soon give rise to implant-related complications, prosthesis failure, or plain dissatisfaction of the patient over the period (Rodrigues et al., 2022). In the final analysis, the clinical mindset of the factors influencing immediate versus delayed prosthetic placement has to remain individualized relative to patient-specific anatomical, functional, and psychosocial factors. Clear guidelines and protocols for both approaches are prerequisites of improving predictability and assure success for

restorative treatments.



VII. TECHNOLOGICAL ADVANCEMENTS ENABLING IMMEDIATE PLACEMENT

The concept of immediate placement and fabrication is aided by placing implants into extraction sites while the bone heals and remodels, followed by fabrication of the final prosthesis; although the existence of these procedures has been aided by technological progress in digital dentistry, their feasibility and success have been somewhat determined. Intraoral scanning, CAD/CAM, CBCT, guided surgeries, and digital implant planning software, when mutually interfaced, have revolutionized conventional workflows to allow same-day prosthetic rehabilitation of greater precision, predictability, and ease for the patient (Singh & Prasad, 2020). One of the prominent technologies in this backdrop has been CAD/CAM. A CAD/CAM allows designing and manufacturing restorations of the highest precision directly inside the dental clinic, thus saving time and costs associated with lab-based workflows. Such systems embrace immediate chairside prosthetics as they allow the design and milling, on the same day, of temporary or definitive restorations with high precision and esthetic value (Martínez-Rus et al., 2022). Intraoral scanners have replaced conventional impression techniques to a reasonable extent. It offers real-time accurate digital impressions, thereby eliminating patient discomfort and enhancing communication between the clinician, dental technician, and patient. The digital scans can integrate immediately into the design software, facilitating swift band fabrication-which is a must for effective immediate placement (Alghazzawi, 2021). CBCT has become an implant planning mainstay: it provides threedimensional imaging of the bone and

surrounding anatomical structures. It allows clinicians to assess implant sites with utmost precision, guaranteeing whose implant placement and angulation ideal for immediate loading protocols (Kumar et al., 2021). The digital implant planning and guided surgery technologies also enable the virtual placement of implants using software before the actual surgery, thus improving the predictability of implant placement in esthetically sensitive or anatomically challenging cases while simultaneously reducing surgical time and allowing for prostheses to be pre-fabricated for immediate delivery (Chrcanovic & Albrektsson, 2022). With developments in materials science for high-strength ceramics such as lithium disilicate and monolithic zirconia, highly durable and esthetic restorations for immediate function were made possible. With these materials now amenable to being milled in the office, they help further short-circuit the immediate prosthetic workflow (Patel & Singh, 2020). Collectively, these technologies have drastically decreased the treatment duration while improving the precision, esthetics, and satisfaction of the patients, thereby enabling immediate prosthetic placement as a viable option into the routine practice, given proper case selection and clinical protocols.

VIII. DISCUSSION

Immediate versus delayed chairside prosthetic placement offers a plethora of clinically significant observations. Immediate prosthetics reduce treatment time, increase patient satisfaction, and provide enhanced esthetic results, particularly in the anterior region where soft tissue preservation is paramount (Martínez-Rus et al., 2022). The advent of digital technology such as CAD/CAM and intraoral scanning has made these protocols a reality by creating prosthetics that can be finished and delivered on the very same day (Singh & Prasad, 2020). However, for immediate placement to succeed, absolute attention must be paid to case selection parameters of sufficient primary implant stability, favorable bone quality, and lack of systemic or local risk factors (Chrcanovic & Albrektsson, 2022). Failure to meet these prerequisites could cause an increase in implant failures, peri-implant complications, and prosthetic adjustments. Delayed placement protocols, by contrast, have the benefit of an extended treatment timeline that takes a more conservative view with consideration for

osseointegration and soft tissue healing, possibly improving long-term stability and prosthetic longevity (Al Harbi et al., 2021). The literature under review is, however, much affected by heterogeneity in study designs, follow-up durations, and outcome measures that hamper direct comparison (Patel & Singh, 2020). Most of the presently available evidence discourages the immediate protocol; however, this is mainly for select patients and more so because long-term data are limited, thereby pointing to an urgent need for the conduction of randomized controlled trials in the future with standardized protocols. Besides, digital workflows have metamorphosed chairside prosthetics, bringing with them precision and ease-of-use that require extensive operator training and a heavy financial outlay (Martínez-Rus et al., 2022). In striving for the best possible outcome, clinicians cannot disregard the interplay of these parameters with their patient's biological considerations.

CONCLUSION

Having put it plainly, neither immediate nor delayed chairside prosthetics offer all advantages and limitations, which consequently affect treatment outcomes in restorative dentistry. With the advancing of digital technologies such as CAD/CAM and intraoral scanning, the immediate prosthetic placement tends to offer advantages such as reducing the total treatment duration, minimizing the physical discomfort of the patient, and allowing for immediate esthetic and functional rehab. These factors, when applied along with strict clinical protocols with proper case selection and precision surgery, enhance patient satisfaction as well as psychosocial outcomes. In contrast, in cases with compromised bone quality, complex anatomical situations, or systemic conditions, delayed prosthetic placement remains a tried-and-tested protocol. Owing to long healing times, the delayed protocol favors biological phenomena like osseointegration and soft tissue maturation, which eventually allow for better long-term prosthetic stability and a decreased chance of biological complications. Hence, the choice between immediate and delayed prosthetics must be made on a case-by-case basis, taking into consideration the health of the patient, the condition of the bone and soft tissues, esthetics, clinician experience, and available technological tools. Also, one must consider the

dangers that premature loading may bring in immediate protocols: implant failure and peri-implant disease should be considered; therefore, risk assessment and patient education must take precedent. Despite promising results from both techniques, the current evidence base is weakened by variability in study designs and small numbers in sample size and in follow-up duration. Large-scale randomized controlled trials with standardized outcome measures and long-term follow-up of biological and prosthetic parameters should thereby be conducted in the future to further advance clinicians' decision-making ability and formulate more concrete treatment protocols. With a promising research base, the future of merging technology and evidence-based clinical practice to maximize prosthetic success and patient satisfaction in the field of restorative dentistry further highlights the responsibilities of continuing education, skill acquisition, and multidisciplinary collaboration.

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