Keywords

Oral rehabilitation; Prosthodontics; Digital dentistry; Implant-supported prostheses; CAD/CAM technology

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Received-16-05-2026
Revised-20-06-2026
Accepted-25-06-2026
Doi:10.1922/ejprd.v34i4s.1448

A Comprehensive Review of Oral Rehabilitation Approaches in Stomatology: From Diagnosis to Prosthetic Restoration

Abstract

Background: Oral rehabilitation in stomatology involves the restoration of function, esthetics, and oral health through a combination of diagnostic, therapeutic, and prosthetic interventions. Recent advancements in prosthodontics and digital dentistry have substantially transformed contemporary rehabilitation strategies.

Objective: To provide a comprehensive overview of current oral rehabilitation approaches, from diagnosis and risk assessment to prosthetic restoration, including emerging digital technologies and long-term clinical outcomes.

Methods: A narrative synthesis of contemporary literature was undertaken, incorporating evidence from systematic reviews, clinical studies, and consensus reports related to diagnostic protocols, treatment planning, prosthetic modalities, and digital innovations in oral rehabilitation.

Results: Effective oral rehabilitation requires an integrated, multidisciplinary approach that combines accurate diagnosis, individualized treatment planning, and appropriate selection of prosthetic modalities. Tooth-supported, removable, and implant-supported prostheses remain fundamental treatment options, each with distinct indications and limitations. The adoption of digital technologies, including intraoral scanning, CAD/CAM systems, and guided implant surgery, has enhanced precision, efficiency, and reproducibility. However, biological and mechanical complications continue to influence long-term outcomes, necessitating structured maintenance protocols. Patient-reported outcomes, particularly quality of life and satisfaction, are increasingly recognized as essential indicators of treatment success.

Conclusion: Contemporary oral rehabilitation is defined by the integration of evidence-based clinical practice and advanced digital technologies. A patient-centered, multidisciplinary approach is essential for achieving predictable and sustainable outcomes, while ongoing technological innovations are expected to further refine future rehabilitation strategies.

1. Introduction

Oral rehabilitation is a major part of modern stomatology, and it aims at restoring oral function, esthetics, and structure in individuals whose dentition and other associated oral diseases are partially or completely lost. It is an interdisciplinary and holistic field that conducts diagnostic assessment, treatment planning, and artificial replacement of oral health to facilitate the best oral health outcomes. In addition to restoring lost teeth, oral rehabilitation is a holistic maneuver that involves both biological, biomechanical and patient centered determinants to guarantee long term success and stability [1].

The impact of oral functional impairment is a serious health issue of the whole world and the leading factors are edentulism, partial loss of teeth,

severe tooth wear, trauma, and oncologic defects.

They not only impair the masticatory efficiency and speech, but also have a negative impact on the esthetics The loss of teeth which is usually associated with dental caries and periodontal disease remains widespread especially in the aging population which causes progressive alveolar bone resorption and functional limitations. Also, complex clinical conditions like maxillofacial defects after oncologic resection also pose a challenge to the traditional rehabilitation strategies, necessitating new and more complex treatment plans in individual cases.

Clinically, oral rehabilitation is focused on the restoration of vital oral functions such as mastication, phonetics, and occlusal stability and at the same time improve esthetic results[3]. The correlation between functional and esthetic rehabilitation is significant because inappropriate restoration can lead to biomechanical complications, occlusiveness disharmony, and dissatisfaction in patients. Hence effective rehabilitation requires a comprehensive knowledge of occlusion, material characteristics and sites of prosthetic designs, and a keen evaluation of individual patient variables including systemic health, expectations and compliance [4].

Traditionally, oral rehabilitation has been changing the classic methods of prosthodontics, such as removable and fixed dental prostheses into more sophisticated implant-supported ones. The implant dentistry has brought a lot of change in the management of the edentulous and partially edentulous patients in terms of enhancing retention, stability and preservation of alveolar bone. The predictability and high survival rates of implant-supported prostheses have been identified as systematic evidence in the application of these types of prostheses in the modern practice, which has gained great acceptance as a treatment modality[5]. Nevertheless, the implant therapy also brings about other issues on the surgery planning, the design of prosthetics, and maintenance in the long run, which require selecting such cases carefully and assessing the risks involved in the process[6,7].

Oral rehabilitation has continued to be transformed by the incorporation of digital technologies in the recent years. Adopting the entire digital workflow in the field of prosthodontics has increased the accuracy, effectiveness, and repeatability of the treatment, allowing clinicians to simplify the diagnosis to the end restoration process. Such intraoral scanning systems, e.g., have become credible alternatives to traditional methods of impression, providing a better patient experience and a high standard of clinical efficacy [8]. The progress of digital impression accuracy, especially in full-arch restoration, has been facilitated by the introduction of new methods of evaluation and validation procedures [9].

In addition, the comparison of digital and conventional prosthetic work processes has also shown considerable benefits regarding less time spent on treatment and less expensive device, and better patient-centered results[10]. In parallel to these technological breakthroughs, there has been an increase in the range of oral rehabilitation due to technological breakthroughs in the manufacturing processes and dental materials. Through the additive manufacturing technologies, such as 3D printing, it is now possible to create complex and high precision prosthetic parts with the possibility of high customization capabilities[11].

Material science is still central to the development of the performance and durability of prosthetic restorations. The emerging materials such as CAD/CAM-processed polymers and superior ceramics have also shown better mechanical features and esthetic results and have contributed towards their growing clinical use. Nevertheless, with all these improvements, oral rehabilitation is a complicated and developing area, which is associated with numerous treatment methods and different clinical results.

The issues continue to revolve around the inclusion of new technologies into the existing clinical guidelines, maximizing their long-term effectiveness, and meeting the individual needs of patients at a reasonable price. Moreover, there is an accelerated nature of innovation, and so new methods and materials require constant assessment as to their clinical soundness and usability.

Thus, the current review strives to ensure a partial and evidence-based assessment of the modern day oral rehabilitation methods in stomatology that includes the continuum of diagnosis and treatment planning to the prosthetic restoration. This review aims to provide clinicians with a systematic approach to a decision-making process, reveal the most important aspects of clinical practice, and discover the future perspectives of its progress to achieve better outcomes in oral rehabilitation by synthesizing the existing evidence and technological improvements.

2. Methodology

2.1 Literature Search Strategy

The search of the literature was organized to find the studies that were related to the subject of oral rehabilitation in stomatology with the focus on diagnosing assessment, treatment planning, full rehabilitation with prosthetic, and digital technologies. A systematic search was performed in electronic databases, such as PubMed/MEDLINE and Web of Science, by using a set of keywords and controlled vocabulary keywords. The search methodology used included the following: oral rehabilitation, prosthodontics, implant-supported prostheses, digital dentistry, CAD/CAM, intraoral scanning and prosthetic restoration. Refining of the search was performed using the Boolean operators (AND, OR) to make sure that all relevant studies were retrieved. Further screening of the reference lists of the selected articles and other relevant reviews was also done manually in order to find more relevant literature.

2.2 Study Selection Criteria and Process

The studies were narrowed down to a set of pre-established eligibility criteria in order to narrow down to the scope of oral rehabilitation. Peer-reviewed articles, such as clinical studies, randomised controlled

trials, observational studies and systematic reviews were considered. The research that covered diagnostic modalities, treatment planning, prosthetic rehabilitation modalities, implant-based therapies and digital workflows were taken into consideration. Articles published in English only were taken into account.
Surveys were also not included because they were case reports, small case series that had limited external validity, editorials, or were opinion-based publications. After the search in the database, all the retrieved records were filtered in terms of titles and abstracts. Full-text evaluation was then done to verify the eligibility of potentially relevant articles. This was done in a step-based process of selection to have a focused and relevant body of literature to analyze.

2.3 Data Organization and Synthesis of Evidence

Applicable information contained within the comprising studies was systematically organized and grouped into the key thematic areas such as diagnostic methods, treatment planning interventions, prosthetic rehabilitation methods, digital innovations, and clinical results. The method of narrative synthesis was used to combine the findings of different studies, which made it possible to compare the traditional, implant-supported, and digitally driven rehabilitations.
The synthesis has highlighted the process of determining the trends that prevail, clinical applicability and areas of consensus in the literature. Differences in study design and outcomes reported were taken into account in the interpretation in order to make a balanced and clinically meaningful account of the present oral rehabilitation practice.

3. Diagnostic and Risk Assessment in Oral Rehabilitation

Oral rehabilitation relies on a systematic, diagnostic and risk assessment model, which gives rise to the premise of specific treatment planning based on evidence. Since oral rehabilitation is a multifactorial process, a systematic assessment of patient-specific issues, clinical observations, and the possible risk factors is needed to achieve maximum functional and prosthetic results.

3.1 Patient-Centered Clinical and Systemic Evaluation

Diagnostic process starts with an elaborate evaluation of patient medical, dental and behavioral conditions and systemic conditions. Systemic health status, medication history, and lifestyle habits including smoking and oral hygiene habits have a significant bearing on determining viability of treatment and prognosis. The aspects are especially pertinent to the field of prosthodontic and implant-based rehabilitation where the biological response and healing ability have a major impact on the outcomes.
Comprehensive dental history, past restorations, failures, and patient expectations are also added to the treatment planning as they help to detect etiological factors, which influence clinical decisions. This patient-focused care will make sure that the rehabilitation plans are in line with the functional needs and long-term clinical stability.

3.2 Structural and Periodontal Assessment of Oral Tissues

The clinical assessment of the oral tissues is required in the assessment of the condition and appropriateness of the abutment structures. Hard tissue examination involves identification of caries, tooth wear, fractures, and integrity of the structure which directly affect the design and material choice of a prosthesis. It has been shown that the survival and complication of tooth-supported restorations are strongly related to the state of supporting structures and restorative materials[12].
Mucosal health and periodontal health are also part of soft tissues that need to be evaluated when determining treatment prognosis. The most important factor that defines the success of both implant-supported and tooth-supported prosthesis in the long run is periodontal stability. The research has revealed that the state of the supporting tissues and preservation of periodontal health play a crucial role in biological complications and the results of prosthetics when used as supplementary support of organs and tissue regeneration in the body, based on their condition and sustainability in the body[13].

3.3 Functional and Occlusal Risk Evaluation

In determining biomechanical risks that come along with oral rehabilitation, functional assessment is paramount. To provide stability in the occlusion and to avoid mechanical complications, the assessment of the occlusion, the vertical dimension, the function of the temporomandibular joint (TMJ), and parafunctional behaviors, including bruxism, is required.
It has been clinically noted that biomechanical factors and occlusal loading patterns play a vital role in the survival and complications of fixed dental prostheses[14]. Equally, minimal invasive restorations, including resin-bonded prostheses, necessitate a careful plan of occlusal planning to guarantee sufficient distribution of loads and eventual success in the long-term [15].

3.4 Radiographic and Digital Diagnostic Modalities

Improvement of imaging and digital technology has increased the accuracy of diagnosis and predictability of treatment in the rehabilitation of the mouth. Cone-beam computed tomography (CBCT) offers an in-depth, three-dimensional scanning of the anatomical structures, allowing one to check and evaluate the quality of bones, the location of the implants, and the spatial orientation.
Digital technology, such as intraoral scanning and digital smile design, allows a better visualization and treatment simulation as well as clinician-patient communication. The technologies aid in the accurate planning of prosthetics and combining the surgical and restorative processes. Figure 1 presents the clinical process of diagnostic assessment and risk identification in oral rehabilitation.

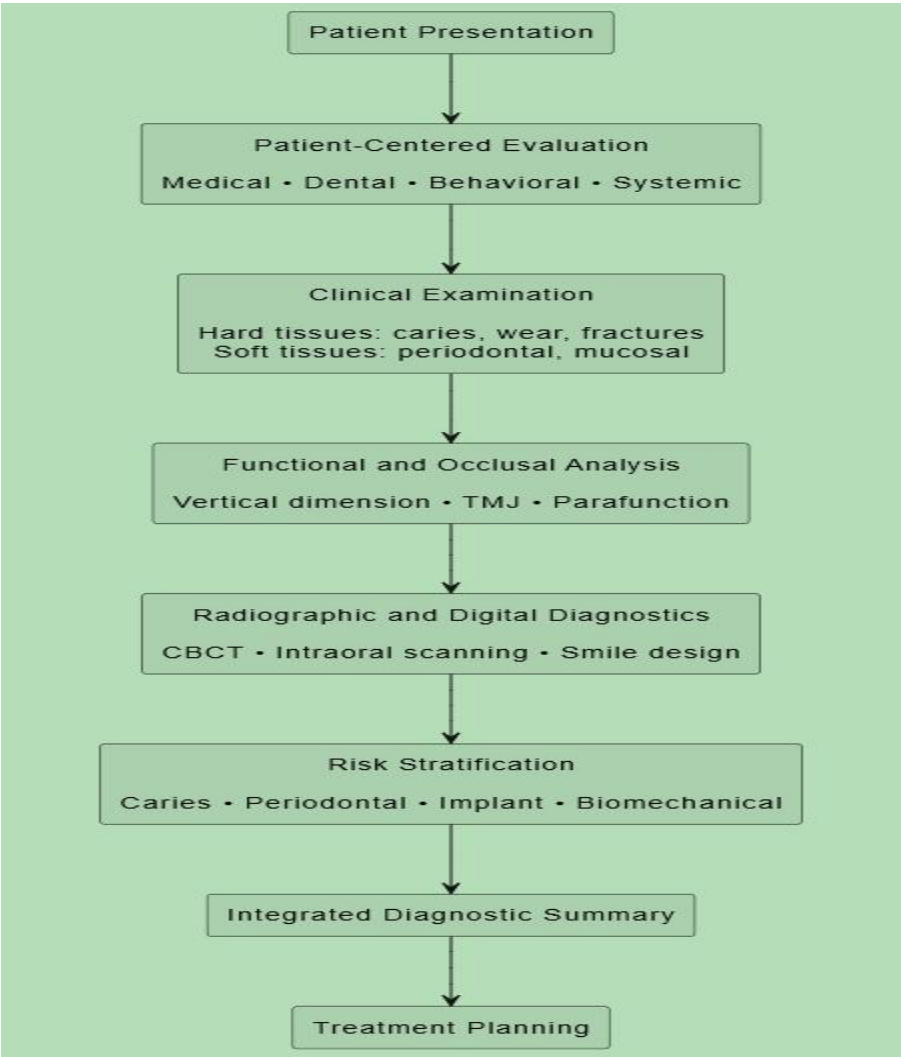

Figure 1. Integrated Diagnostic Pathway for Oral Rehabilitation

3.5 Risk Stratification and Prognostic Considerations

Risk stratification plays a critical role in forecasting the treatment outcomes, as well as determining clinical judgment in oral rehabilitation. Such variables as the predisposition to caries, periodontal health, biomechanical loading, and implant-specific variables have to be considered.

The risk assessment associated with implant is critical as the loading programs, the status of the bone, and the patient-specific factors play an important role in determining the clinical success. The clinical recommendations focus on proper loading plans and patient selection that can improve the outcome of implants to the maximum level[16]. Long-term studies also have a biological and mechanical complication of implant supported prostheses, and it has been indicated that they require close monitoring[17].

The design of a prosthetic, such as the method of attaching the prosthetic in an implant overdenture, may determine retention, stability and complication. Comparative studies reveal that there is indeed a variation in the performance of various systems and the significance of individualized treatment planning is stressed as a result of this variance[18,19]. These factors add to a risk-compensated strategy in an attempt to enhance the long-term outcome of rehabilitation.

4. Treatment Planning and Multidisciplinary Integration

Oral rehabilitation planning treatment necessitates a coherent and evidence-based approach involving the combination of diagnostic results, biological bias, functional needs, and patient-related elements. Taking into consideration the oral rehabilitation complexity, planning should go beyond the replacement of the prosthetic to the maintenance of the new prosthetic in the long-run, the risks management and the interdisciplinary coordination.

4.1 Principles of Rehabilitation Planning

Oral rehabilitation is founded on the systematic treatment planning, which is based on the accurate diagnosis and prognostic assessment. The main goal is to develop consistent and working oral environment and reduce biological and mechanical complications. Recent progress in diagnostic methods including damping capacity assessment, has demonstrated possible enhancement in the assessment of peri-implant bone states and a better clinical decision-making process [20].

The patient factors should be taking into consideration as the patient factors are the ones that play a major role in the treatment outcome. Smoking, as an example, has

been found out as a significant risk factor that negatively influences implant survival, osseointegration and peri-implant tissue well-being[21]. As such, clinicians ought to consider these risk factors and apply the right preventive or corrective measures before making a treatment.

Besides, the design of implants is also very important in the long-term success. Platform switching has been linked to increased maintenance of marginal peri-implant bone levels, and the significance of prosthetically driven implant selection in the treatment planning process has been emphasized twice as of now[22]. All these factors highlight the importance of unique and risk-based planning strategies. The Table 1 provides a summary of the main domains and clinical considerations in the treatment planning and multidisciplinary integration in oral rehabilitation. It emphasizes the significance of patient related factors, biological risk management as well as evidence based decision making in maximizing treatment outcomes.

Table 1. Treatment planning and multidisciplinary integration in oral rehabilitation

Domain of Treatment Planning	Key Clinical Parameters	Clinical Relevance	Supporting References
Rehabilitation planning	Diagnostic findings, peri-implant bone status, implant design	Enables predictable treatment planning and prognosis	[20,22]
Patient-related factors	Smoking, systemic health, compliance, expectations	Influences healing, implant survival, and long-term outcomes	[21]
Multidisciplinary coordination	Prosthodontics, periodontics, implantology, surgery, endodontics	Ensures integrated biological and prosthetic management	[23]
Biological risk management	Peri-implantitis, inflammation control, maintenance therapy	Reduces complications and improves implant longevity	[24]
Occlusal rehabilitation strategies	Centric relation, occlusal scheme, vertical dimension	Maintains biomechanical stability and reduces prosthetic failure	[22]
Treatment planning approaches	Conventional and digital workflows	Enhances accuracy, efficiency, and treatment predictability	[25]
Evidence-based decision pathways	Disease classification, diagnostic criteria	Supports standardized and consistent clinical planning	[26]
Peri-implant health maintenance	Tissue stability, inflammation monitoring, long-term follow-up	Critical for sustained success of rehabilitation	[27]

4.2 Multidisciplinary Coordination and Patient-Centered Planning

Oral rehabilitation may involve the combination of various fields of dentistry, where prosthodontics, periodontics, implantology, oral surgery and endodontics are among the disciplines to be considered. This is a treatment that is multidisciplinary in nature and therefore both the biological and functional components of the treatment are fully covered. Specialty coordination is especially crucial in complicated cases of the impaired periodontal status, loss of a vast number of teeth, or restorations on the basis of implants.

The initial effects of the treatment are not the only factors that contribute to long-term success but also the adoption of effective maintenance measures. It has been demonstrated that supportive maintenance therapy can substantially decrease the rates of peri- implant diseases and enhance long term clinical outcomes[23]. Peri-implantitis is one of these conditions and a health issue of high biological complication that may jeopardize implant success in case of failure to diagnose and manage it, as indicated by relevant studies[24].

Treatment planning requires giving consideration to the patients. Issues like the overall health, patient expectations, adherence to oral hygiene practices, and financial situations will have to be considered. An individualized and realistic treatment plan ought to be able to balance the optimal clinical outcomes with the potential of the patient to sustain the long-term wellbeing of his or her oral health. This practice increases the treatment adherence as well as optimizing prognosis.

4.3 Occlusal, Prosthetic, and Evidence-Based Decision Pathways

Occusal rehabilitation is an essential part of the treatment planning because it directly affects the biomechanical stability and the duration of the prosthetics. The correct centric relation, choosing the correct occlusal schemes, and restoration of the vertical dimension are obligatory aspects of providing balance in the distribution of forces. Poorly planned occlusals can result in overloading, failure of the prosthetic or biologic complications.

Evidence based decision making is at the centre stage in the process of maximizing treatment outcome. A standardized classification of peri-implant diseases and conditions in consensus helps to give a framework of diagnosis and clinical treatment planning, which allows consistency in clinical practice in practice[25]. Moreover, it has explicitly defined diagnostic measures of peri-implant health, peri-implant mucositis, and peri-implantitis, which makes it easier to diagnose and implement suitable intervention plans in clinical cases further [26].

The idea of peri-implant health is part of the primary focus of the oral rehabilitation concept, which underlines the significance of stable supporting tissues, lack of inflammation, and long-term biological compatibility[27]. By incorporating these evidence-based principles in the treatment planning process, the

clinician would be able to create predictive and sustainable rehabilitation plans.

5. Prosthetic Rehabilitation Modalities

Prosthetic rehabilitation is an essential part of oral rehabilitation expected to bring back the functions, esthetics, and the quality of life of the patient. The choice of a suitable type of prosthetic modality is determined by the level of tooth loss, health of the supporting tissues, health of the system, and their individual factors.

5.1 Tooth-Supported Rehabilitation

Tooth-supported rehabilitation is still considered as first-line rehabilitation in patients having sufficient residual dentition and good periodontal outcomes. The crowns and fixed partial dentures are comparatively popular in restoring structural stability, occlusiveness and esthetics. The success of their sanity in the long term relies on the correct cases choice, periodontal health, and preservation of the surrounding tissues.

Epidemiological data points to the importance of peri-implant and periodontal health as crucial predictors of the future success of the prosthetic in the long term[28]. Premature inflammatory diseases like peri-implant mucositis need to be diagnosed and treated to avoid the development of the disease further[29]. Moreover, the evidence of accumulated plaque has been demonstrated to have adverse effects on the processes of osseointegration and the health of tissues around them, which explains the need to adopt effective oral care and management strategies [30].

Adhesive and minimal invasive restorations are also more conservative, and they allow the preservation of tooth structure with functional rehabilitation[31].

5.2 Removable Prosthodontics

Removable prosthodontics continues to be a significant mode of treatment, especially in those patients who have lost numerous teeth, are anatomically constrained or contraindicated to implant treatment. Full dentures are usually employed with edentulous patients, and in older populations, where the major aim is restoration of performance and quality of life[32,33]. Their further applicability in geriatric care is also supported by evidence as it is non-invasive and available to everyone [34].

Removable partial dentures give a low-cost and less invasive approach to partially edentulous patients. Nevertheless, the areas of their usage can affect the periodontal health based on the material design and hygiene. According to clinical researches, there are some denture materials whose effects on periodontal tissues may be short-term, so patient selection and care should be handled with care and caution in these situations [35].

Advancements in digital dentistry have improved removable prosthodontics. Intraoral scanning allows accurate acquisition of hard and soft tissue data for prosthesis fabrication[36], while CAD/CAM technologies enhance precision and reproducibility in denture production[37]. Despite these advancements, removable prostheses may present limitations such as reduced retention, discomfort, and the need for periodic adjustments. Figure 2 illustrates the main prosthetic rehabilitation modalities used in oral rehabilitation, including tooth-supported, removable, and implant-supported approaches. These modalities collectively contribute to the restoration of function, esthetics, and patient quality of life.

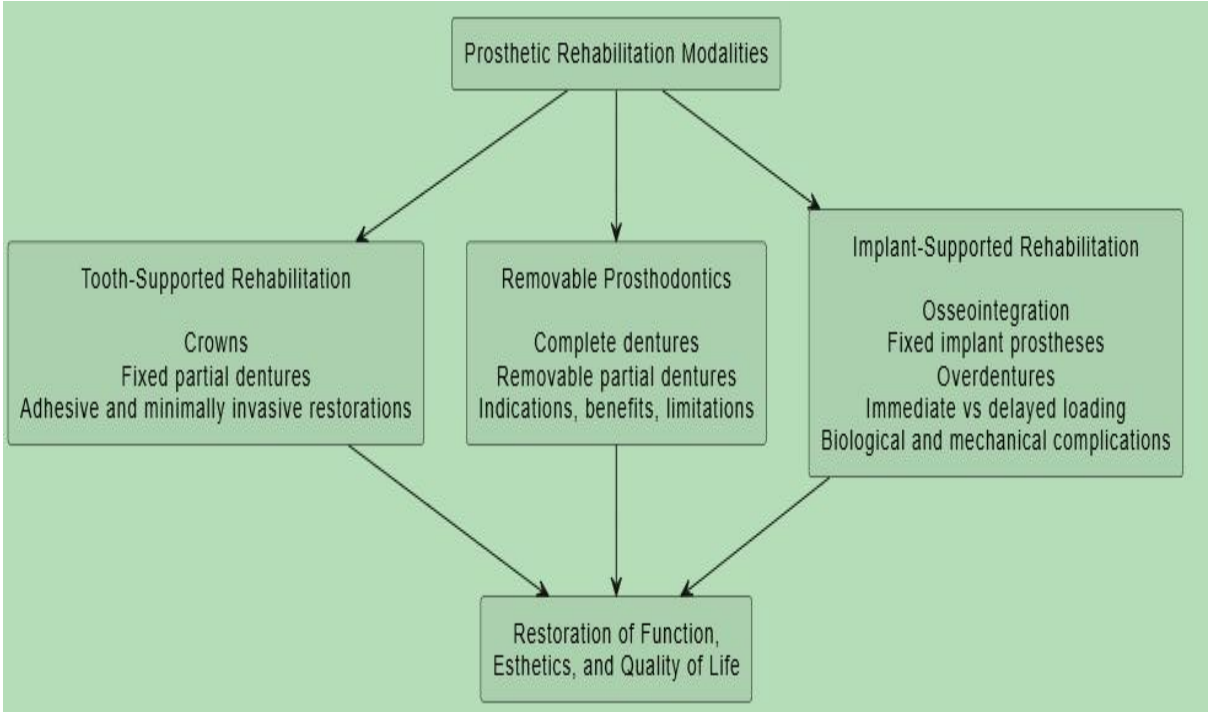

Figure 2. Prosthetic rehabilitation modalities in oral rehabilitation

5.3 Implant-Supported Rehabilitation

The use of implant-supported rehabilitation is a major modality because it offers a better retention, stability

and maintenance of the alveolar bone. The effectiveness of implant therapy is founded on the process of the implantation of the organism; still, the long-term results are determined by the preservation of the health of the peri-implant tissue and prevention of the development of the disease.

The significance of peri-implant therapy in long-term supports is supported by the fact that supportive peri-implant therapy is important in peri-implantitis and implant loss prevention[38]. The problem of peri-implant tissue destruction is still a major clinical issue with consensus reports that have raised concerns about the need to diagnose and intervene early.

Implant-supported dentures can be presented in the form of fixed restorations or overdenture based on the anatomy and the preferences of the patient. Both immediate and delayed loading protocols are potentially successful given that proper case selection and biomechanical considerations are considered. Nevertheless, during planning and follow-up, biological and mechanical complications always need to be taken into account.

6. Digital Dentistry and Technological Innovations

Digital dentistry has made a serious impact on the practice of prosthodontics in enhancing the accuracy of diagnosis, treatment planning, and creation of prostheses. Oral rehabilitation workflows have been shifted to become more efficient, standardized and patient-centered with the integration of digital technologies.

6.1 Digital Impressions and Data Acquisition

Basing on the advantages of the digital impressions compared to the traditional technique, they are less distorted, more accurate, and more comfortable to the patient. The use of optical scanning technologies allows exact registration of structures of the intraoral environment and excludes the errors inherent in the use of impression materials and cast creation.

Digital acquisition of data also enables real-time visualisation and transfer of information among clinicians and laboratories and, as a result, enhances communication and workflow efficiency. These benefits are associated with less chairside time and clinical predictability.

6.2 CAD/CAM Technologies and Prosthesis Fabrication

Standardized and precise production has brought out computer-aided design and computer-aided manufacturing (CAD/CAM) technologies that have revolutionized the fabrication of prosthetics. These processes encompass subtractive (milling) and additive (3D printing) manufacturing processes.

Complete denture systems made by CAD/CAM have better material property and consistency in terms of conventional techniques. Fracture resistance of CAD/CAM denture base resin is also improved, which contributes to their strength anew, and research has already led to positive biocompatibility and surface properties of digitally milled prostheses [39,40].

Moreover, CAD/CAM fabrication enhances denture adaption and clinical evidence demonstrates that milled dentures than the conventional counterparts have a better retention rate. The table 2 summarizes the most popular digital technologies applied in prosthodontic rehabilitation, their use in clinical practice, benefits, and drawbacks.

Table 2. Digital technologies in prosthodontic rehabilitation

Technology	Clinical application	Key advantage / limitation	References
Digital impressions	Intraoral data capture and digital workflow integration	Improved efficiency and communication / operator and equipment dependence	[44]
CAD/CAM fabrication	Denture base and prosthesis fabrication	High precision and material consistency / higher initial cost	[38,39,40]
Denture adaptation and retention	Complete denture fabrication	Better fit and retention / technique-sensitive workflow	[41,42]
Digital complete dentures	Edentulous and full-arch rehabilitation	Standardized design and reproducibility / limited accessibility in some settings	[43,44]
Virtual implant planning	Guided implant placement and prosthetic planning	Improved accuracy and predictability / software-dependent planning	[45]
Artificial intelligence and emerging tools	Diagnostic support and prosthetic planning	Potential for improved decision-making / limited current clinical validation	[45]

6.3 Digital Complete Dentures and Virtual Implant Planning

Full-arch rehabilitation and the full fabrication of dentures have tremendously improved as a result of digital workflow[41,42]. The digital systems that are used allow precise data collection, virtual designing, and automatic production, which enhance efficiency and minimize variability. Clinical use, as well reproducibility, has increased with the development of computer-aided denture fabrication to enhance clinical use and reproducibility[43].

Virtual treatment planning in the field of implant dentistry enables placing of implants which are driven by the prosthetic on anatomically and functional basis of the patients. Guided implant surgery directs the digital plans into clinical practice enhancing the accuracy and treatment outcome. Such planning is critically important in edentulous rehabilitation because of evidence-based approaches to the problem[44].

6.4 Emerging Technologies, Advantages, and Clinical Applicability

Digital dentistry is growing more and more to include emerging technologies like artificial intelligence, which can be used to improve the accuracy of diagnosis and treatment plans. AI-powered systems can be used to aid the data analysis process, the design of prosthetics, predicting their outcome, and, as a result, enhance the processes of decision-making.

Digital dentistry has a number of benefits, such as being more accurate, reproducing, spending less time on treatment, and increasing patient experience[45,46]. But we have to take into consideration limitations like; high initial cost, technical complexity and probable learning curves. Nevertheless, these obstacles do not reduce the importance of digital workflows in the context of contemporary oral rehabilitation since they gain increased clinical relevance.

7. Clinical Outcomes, Complications, and Long-Term Maintenance

Oral rehabilitation and recovery of favorable clinical outcomes, reduction of complications and maintenance of long-term outcomes determines the success of this group of interventions. All these factors influence the functional, esthetic and biological stability of the prosthetic treatments.

7.1 Clinical Outcomes

Clinical outcomes are usually determined through survival rates of prosthesis and functioning. The key goal of rehabilitation is restoration of mastication, speech and occlusive stability. Extensive tooth wear, such as, may seriously harm occlusal functioning and needs well organized management measures to regain balance of functionality.

Rehabilitation methods like the shortened dental arch concept have been shown to allow a reasonable oral functionality and quality of life to be sustained in the long term in partially edentulous patients [47,48]. Also, prosthetic rehabilitation has been shown to be important in the reconstruction of function and esthetics of the face in patients with extensive disease or surgical defects, especially in cases of maxillofacial or oncologic surgeries.

7.2 Complications in Oral Rehabilitation

Oral rehabilitation complications can fall into the categories of biological, mechanical, and disease-related complications. Biological complications consist in infections, inflammatory processes in the mucosae, tissue degradation. Often, tissue damage can be very severe in some instances like mucormycosis, and complex prosthodontic treatment is necessary to restore its function and appearance[49,50].

Occlusal overload, material fatigue, or inappropriate design is commonly attributed to mechanical complications such as the fracture, wear and loosening of a prosthesis. The results in implant-supported rehabilitation can also depend on surgical issues like grafting, which can determine the stability of the implants and the success in the long term.

Furthermore, inaccuracies in impression techniques may lead to prosthetic misfit, emphasizing the importance of precise clinical and digital workflows in reducing complications and improving outcomes. Figure 3 shows the interrelationship between clinical outcomes, complications, maintenance, and patient-reported outcomes in oral rehabilitation.

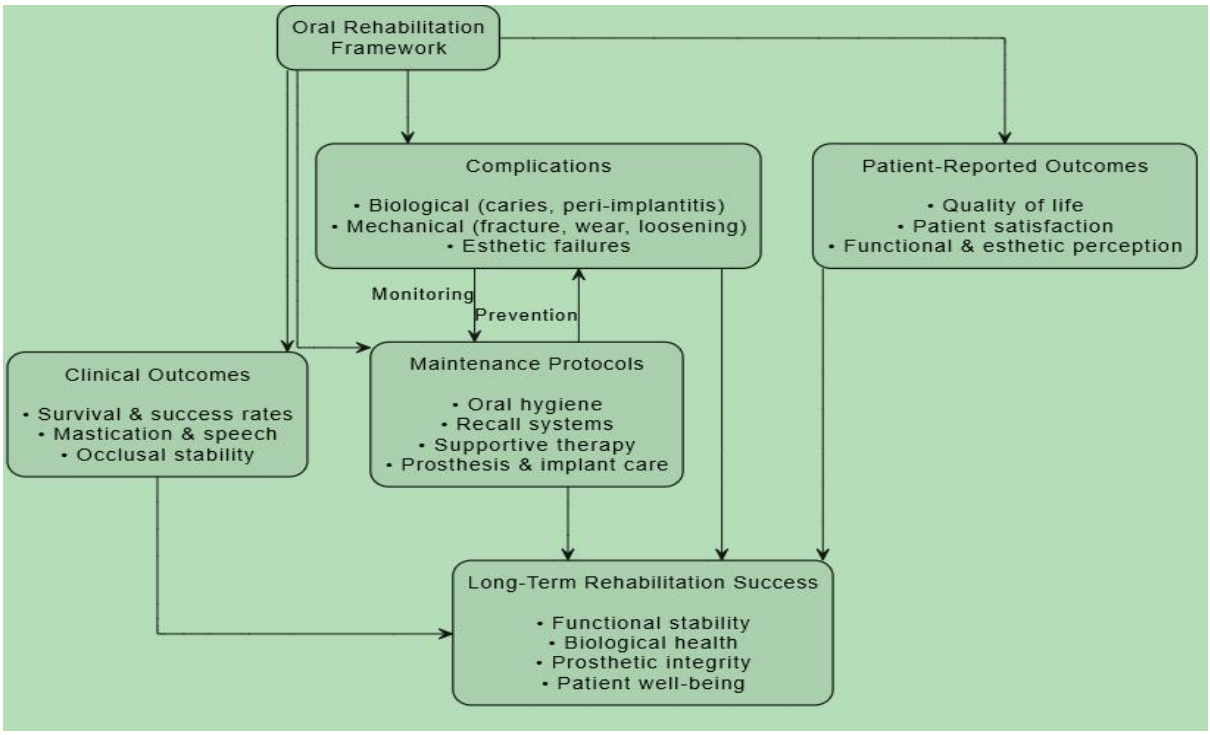

Figure 3. Clinical outcomes, complications, and long-term maintenance in oral rehabilitation

7.3 Maintenance Protocols

Maintenance is necessary in the long term to guarantee the success and durability of the rehabilitation of the

prosthetic. The measures against the disease like good oral health and frequent recall appointments are the key aspects of reducing complications.

Constant monitoring is needed in complicated rehabilitations, such as implant based prostheses and maxillofacial prosthetics to evaluate the tissue health, prosthesis integrity and functional performance. Regulatory procedures of maintenance must involve a consistent review of the prosthetic parts to identify the initial signs of wear, fracture, or loosening.Structured maintenance program does not only help to decrease the rates of complications but also increase the long-term clinical success and patient outcomes.

7.4 Patient-Reported Outcomes

Patient-reported outcomes are important variables of the treatment success and they comprise quality of life, satisfaction, and perceived functional and esthetic improvement. The use of implant-supported prostheses has also been linked to high satisfaction rates among patients especially regarding comfort and stability [51].

On the other hand, edentulism has been found to impact negatively on oral and general health in addition to general quality of living[52]. It has also been shown to be strongly linked with tooth loss and diminished oral health-related quality of life, and it is therefore important that successful prosthetic rehabilitation be applied in enhancing patient welfare [53]. Individual expectations and functional needs-based patient-centered approach is thus a necessity to attaining the best rehabilitation outcomes.

8. Conclusion

Oral rehabilitation has become an interprofessional, holistic field of practice that incorporates diagnostic accuracy, interdisciplinary treatment planning, and high-tech solutions in the form of prostheses. The act of substituting traditional and restorative practices with the use of implants and digital-driven processes has greatly contributed to the predictability, efficiency, and success of the rehabilitation procedures. A critical knowledge of diagnostic guidelines and risk evaluation is critical in identifying the proper choice of treatment modalities and success in the long term. The combination of the prosthodontics, periodontics, implantology and the use of digital technologies can allow clinicians to provide the individual treatment plan that fulfills the functional and esthetic requirements. Specifically, progress in CAD/CAM systems, computerized impressions and computerized guided surgery of implants has enhanced precision and decreased clinical variation. Regardless of these developments, such complications as biological and mechanical failures are still critical factors. Peri-implant and periodontal health requires effective maintenance procedures such as frequent follow-up and supportive therapy. Moreover, patient-reported outcomes, such as the quality of life and satisfaction, also proved to be very important measurements of the success of the treatment process, which implies the consideration of a holistic approach to treatment. Oral rehabilitation directions in the future will be probably motivated by further advancements in digital dentistry and artificial intelligence that can further improve diagnostic quality and treatment plan. Finally, clinical expertise, evidence-based practice coupled with the existence of emerging technologies are to be integrated in a balanced manner to bring about predictable, sustainable, and patient-centered results in oral rehabilitation.

References

1. Papaspyridakos P, Chen CJ, Gallucci GO, Doukoudakis A, Weber HP, Chronopoulos V. Accuracy of implant impressions for partially and completely edentulous patients: a systematic review. International Journal of Oral & Maxillofacial Implants. 2014 Aug 1;29(4).
2. Joda T, Zarone F, Ferrari M. The complete digital workflow in fixed prosthodontics: a systematic review. BMC oral health. 2017 Sep 19;17(1):124.
3. Mangano F, Gandolfi A, Luongo G, Logozzo S. Intraoral scanners in dentistry: a review of the current literature. BMC oral health. 2017 Dec 12;17(1):149.
4. Güth JF, Edelhoff D, Schweiger J, Keul C. A new method for the evaluation of the accuracy of full-arch digital impressions in vitro. Clinical oral investigations. 2016 Sep;20(7):1487-94.
5. Joda T, Brägger U. Digital vs. conventional implant prosthetic workflows: a cost/time analysis. Clinical oral implants research. 2015 Dec;26(12):1430-5.
6. Joda T, Brägger U. Patient-centered outcomes comparing digital and conventional implant impression procedures: a randomized crossover trial. Clinical oral implants research. 2016 Dec;27(12):e185-9.
7. Abduo J, Elseyoufi M. Accuracy of Intraoral Scanners: A Systematic Review of Influencing Factors. The European journal of prosthodontics and restorative dentistry. 2018 Aug 30;26(3):101-21.
8. Revilla-León M, Özcan M. Additive manufacturing technologies used for processing polymers: current status and potential application in prosthetic dentistry. Journal of Prosthodontics. 2019 Feb;28(2):146-58.
9. Methani MM, Cesar PF, de Paula Miranda RB, Morimoto S, Özcan M, Revilla-León M. Additive manufacturing in dentistry: current technologies, clinical applications, and limitations. Current Oral Health Reports. 2020 Dec;7(4):327-34.
10. Al-Dwairi ZN, Tahboub KY, Baba NZ, Goodacre CJ. A comparison of the flexural and impact strengths and flexural modulus of CAD/CAM and conventional heat-cured polymethyl methacrylate (PMMA). Journal of Prosthodontics. 2020 Apr;29(4):341-9.
11. Sailer I, Makarov NA, Thoma DS, Zwahlen M, Pjetursson BE. All-ceramic or metal-ceramic tooth-supported fixed dental prostheses (FDPs)? A systematic review of the survival and complication rates. Part I: Single crowns (SCs). Dental materials. 2015 Jun 1;31(6):603-23.
12. Sailer I, Makarov NA, Thoma DS, Zwahlen M, Pjetursson BE. All-ceramic or metal-ceramic tooth-supported fixed dental prostheses (FDPs)? A

systematic review of the survival and complication rates. Part I: Single crowns (SCs). Dental materials. 2015 Jun 1;31(6):603-23.
13. Pjetursson BE, Valente NA, Strasding M, Zwahlen M, Liu S, Sailer I. A systematic review of the survival and complication rates of zirconia-ceramic and metal-ceramic single crowns. Clinical oral implants research. 2018 Oct;29:199-214.
14. Sailer I, Gottner J, Känel S, Franz Hämmerle CH. Randomized controlled clinical trial of zirconia-ceramic and metal-ceramic posterior fixed dental prostheses: a 3-year follow-up. International Journal of Prosthodontics. 2009 Nov 1;22(6):553.
15. Pjetursson BE, Tan WC, Tan K, Brägger U, Zwahlen M, Lang NP. A systematic review of the survival and complication rates of resin-bonded bridges after an observation period of at least 5 years. Clinical Oral Implants Research. 2008 Feb;19(2):131-41.
16. Hawthan MA, Chrcanovic BR, Larsson C. Long-term retrospective clinical study of tooth-supported fixed partial dentures: A multifactorial analysis. Journal of Prosthodontic Research. 2023;67(2):238-45.
17. Papaspyridakos P, Bordin TB, Natto ZS, El-Rafie K, Pagni SE, Chochlidakis K, Ercoli C, Weber HP. Complications and survival rates of 55 metal-ceramic implant-supported fixed complete-arch prostheses: A cohort study with mean 5-year follow-up. The Journal of prosthetic dentistry. 2019 Nov 1;122(5):441-9.
18. Ali R, Selim K, Nasr S. Bar versus resilient stud anchors used for immediately loaded 2 implants assisting overdentures in patients with history of periodontitis. One-year randomized controlled clinical study. Egyptian Dental Journal. 2022 Jan 1;68(1):339-53.
19. Gallucci GO, Benic GI, Eckert SE, Papaspyridakos P, Schimmel M, Schrott A, Weber HP. Consensus statements and clinical recommendations for implant loading protocols. International Journal of Oral & Maxillofacial Implants. 2014 Jan 2;29.
20. Pyo SW, Kim GY, Chang JS, Kim S. In vivo validation of damping capacity assessment as a diagnostic tool for peri-implant bone loss. Scientific reports. 2025 Jul 31;15(1):27984.
21. Chrcanovic BR, Albrektsson T, Wennerberg A. Smoking and dental implants: A systematic review and meta-analysis. Journal of dentistry. 2015 May 1;43(5):487-98.
22. Strietzel FP, Neumann K, Hertel M. Impact of platform switching on marginal peri-implant bone-level changes. A systematic review and meta-analysis. Clinical oral implants research. 2015 Mar;26(3):342-58.
23. Monje A, Aranda L, Diaz KT, Alarcón MA, Bagramian RA, Wang HL, Catena A. Impact of maintenance therapy for the prevention of peri-implant diseases: a systematic review and meta-analysis. Journal of dental research. 2016 Apr;95(4):372-9.
24. Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis. Journal of clinical periodontology. 2018 Jun;45:S246-66.
25. Berglundh T, Armitage G, Araujo MG, Avila-Ortiz G, Blanco J, Camargo PM, Chen S, Cochran D, Derks J, Figuero E, Hämmerle CH. Peri-implant diseases and conditions: Consensus report of workgroup 4 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. Journal of clinical periodontology. 2018 Jun;45:S286-91.
26. Renvert S, Persson GR, Pirih FQ, Camargo PM. Peri-implant health, peri-implant mucositis, and peri-implantitis: Case definitions and diagnostic considerations. Journal of clinical periodontology. 2018 Jun;45:S278-85.
27. Araujo MG, Lindhe J. Peri-implant health. Journal of clinical periodontology. 2018 Jun;45:S230-6.
28. Derks J, Tomasi C. Peri-implant health and disease. A systematic review of current epidemiology. Journal of clinical periodontology. 2015 Apr;42:S158-71.
29. Heitz-Mayfield LJ, Salvi GE. Peri-implant mucositis. Journal of clinical periodontology. 2018 Jun;45:S237-45.
30. Schwarz F, Mihatovic I, Golubovic V, Bradu S, Sager M, Becker J. Impact of plaque accumulation on the osseointegration of titanium–zirconium alloy and titanium implants. A histological and immunohistochemical analysis. Clinical Oral Implants Research. 2015 Nov;26(11):1281-7.
31. Ramanauskaite A, Tervonen T. The efficacy of supportive peri-implant therapies in preventing peri-implantitis and implant loss: a systematic review of the literature. Journal of oral & maxillofacial research. 2016 Sep 9;7(3):e12.
32. Klinge B, Meyle J, Working Group 2. Peri-implant tissue destruction. The third EAO consensus conference 2012. Clinical Oral Implants Research. 2012 Oct;23:108-10.
33. Schimmel M, Müller F, Suter V, Buser D. Implants for elderly patients. Periodontology 2000. 2017 Feb;73(1):228-40.
34. Müller F. Interventions for edentate elders–what is the evidence?. Gerodontology. 2014 Feb;31:44-51.
35. Fueki K, Inamochi Y, Yoshida-Kohno E, Wakabayashi N. Short-term effect of thermoplastic resin removable partial dentures on periodontal health: A randomized cross-over trial. Journal of Prosthodontic Research. 2022;66(1):167-75.
36. Kattadiyil MT, Mursic Z, AlRumaih H, Goodacre CJ. Intraoral scanning of hard and soft tissues for partial removable dental prosthesis fabrication. The Journal of prosthetic dentistry. 2014 Sep 1;112(3):444-8.
37. Bilgin MS, Baytaroğlu EN, Erdem A, Dilber E. A review of computer-aided design/computer-aided manufacture techniques for removable denture fabrication. European journal of dentistry. 2016 Apr;10(02):286-91.
38. Baba NZ, Goodacre BJ, Goodacre CJ, Müller F, Wagner S. CAD/CAM complete denture systems

and physical properties: a review of the literature. Journal of prosthodontics. 2021 May;30(S2):113-24.
39. Steinmassl O, Offermanns V, Stöckl W, Dumfahrt H, Grunert I, Steinmassl PA. In vitro analysis of the fracture resistance of CAD/CAM denture base resins. Materials. 2018 Mar 8;11(3):401.
40. Srinivasan M, Gjengedal H, Cattani-Lorente M, Moussa M, Durual S, Schimmel M, Müller F. CAD/CAM milled complete removable dental prostheses: An in vitro evaluation of biocompatibility, mechanical properties, and surface roughness. Dental materials journal. 2018 Jul 26;37(4):526-33.
41. Goodacre BJ, Goodacre CJ, Baba NZ, Kattadiyil MT. Comparison of denture base adaptation between CAD-CAM and conventional fabrication techniques. The Journal of prosthetic dentistry. 2016 Aug 1;116(2):249-56.
42. AlHelal A, AlRumaih HS, Kattadiyil MT, Baba NZ, Goodacre CJ. Comparison of retention between maxillary milled and conventional denture bases: A clinical study. The Journal of prosthetic dentistry. 2017 Feb 1;117(2):233-8.
43. Bidra AS, Taylor TD, Agar JR. Computer-aided technology for fabricating complete dentures: systematic review of historical background, current status, and future perspectives. The Journal of prosthetic dentistry. 2013 Jun 1;109(6):361-6.
44. Goodacre CJ, Garbacea A, Naylor WP, Daher T, Marchack CB, Lowry J. CAD/CAM fabricated complete dentures: concepts and clinical methods of obtaining required morphological data. The Journal of prosthetic dentistry. 2012 Jan 1;107(1):34-46.
45. Sadowsky SJ, Fitzpatrick B, Curtis DA. Evidence-based criteria for differential treatment planning of implant restorations for the maxillary edentulous patient. Journal of Prosthodontics on Dental Implants. 2015 Sep 4:87-102.
46. Loomans B, Opdam N, Attin T, Bartlett D, Edelhoff D, Frankenberger R, Benic G, Ramseyer S, Wetselaar P, Sterenborg B, Hickel R. Severe tooth wear: European consensus statement on management guidelines. J Adhes Dent. 2017 Jan 1;19(2):111-9.
47. Reissmann DR, Wolfart S, John MT, Marré B, Walter M, Kern M, Kohal R, Nothdurft F, Stark H, Schierz O, Wöstmann B. Impact of shortened dental arch on oral health-related quality of life over a period of 10 years—A randomized controlled trial. Journal of dentistry. 2019 Jan 1;80:55-62.
48. Patil RB, Chandak A, Radke U, Sahai R, Kumbhare R. Mucormycosis and its prosthodontic management: A review. Journal of Advances in Dental Practice and Research. 2022 Jun 30;1(1):18-23.
49. Laverty DP, Addison O, Elledge R, Parmar S. Oral Prosthodontic Rehabilitation of Head and Neck Cancer Patients. InContemporary Oral Oncology: Rehabilitation and Supportive Care 2017 Jul 25 (pp. 35-104).
50. Phasuk K, Haug SP. Maxillofacial prosthetics. Oral and Maxillofacial Surgery Clinics. 2018 Nov 1;30(4):487-97.
51. Gurgel BC, Pascoal AL, Souza BL, Dantas PM, Montenegro SC, OLIVEIRA AG, Calderon PD. Patient satisfaction concerning implant-supported prostheses: an observational study. Brazilian Oral Research. 2015;29(1):1-6.
52. Emami E, de Souza RF, Kabawat M, Feine JS. The impact of edentulism on oral and general health. International journal of dentistry. 2013;2013(1):498305.
53. Gerritsen AE, Allen PF, Witter DJ, Bronkhorst EM, Creugers NH. Tooth loss and oral health-related quality of life: a systematic review and meta-analysis. Health and quality of life outcomes. 2010 Nov 5;8(1):126.