The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

PATIENT SATISFACTION AND FUNCTIONAL OUTCOMES OF CAD/CAM VERSUS CONVENTIONAL DENTURES

TORNE DURAN, SERGI

Associate Professor, Departament d'Odontoestomatologia, Universitat De Barcelona. Email: sergitorne@ub.edu

Abstract

Digital realm prosthodontics has become an enormous area of development in one application of complete dentures. CAD/CAM technology has become a dominant alternative to conventional methods. This paper compares systematically different outcomes and patient satisfaction between those dentures produced by CAD/CAM and those of classical fabrication. In addressing the subject, there is a discussion of contemporary clinical trials, crossover studies, and meta-analyses on comfort, esthetics, masticatory efficiency, adaptation period, and long-term retention. According to the results, CAD/CAM denture offers greater precision compared with the one of conventional fabrication, and patient-reported satisfaction was also higher for CAD/CAM complete dentures about their oral health–related quality of life (OHRQoL). However, this new method is disadvantageous because of accessibility and cost-effectiveness. Here, the review further discusses why the results may differ between populations, digital methods (milled vs. 3D-printed comprehensive), and evaluation instruments. This discussion provides clues for decision-making; namely, when the patient-centered outcomes bear, the CAD/CAM denture provides a potential advantage over traditional dentures. Nonetheless, randomized controlled trials with standardized measures are still foremost to establish long-term effectiveness.

Keywords: CAD/CAM Dentures, Conventional Dentures, Patient Satisfaction, Oral Health–Related Quality of Life (OHRQoL), Digital Prosthodontics, Masticatory Efficiency.

1. INTRODUCTION

Total edentulism continues to impose public health importance on the aging population. Life expectancy is increasing, while periodontal disease and tooth decay remain chronic conditions; hence, total tooth loss has become a problem with an increasing number of people. The problems extend beyond aesthetic appearance: nutrition, speech, self-esteem, and quality of life are all deeply affected. Therefore, concerning full-mouth prosthetics, the demand for efficacious solutions has increased, imposing pressure on the clinicians to produce dentures that restore not only function but satisfy increasing criteria for comfort, aesthetics, and long-term satisfaction from the patient side.

Conventional complete dentures, widely considered "gold standard," are usually accompanied by a series of clinical and psychosocial complications. These types of complete dentures are fabricated following an analog, multi-step process that starts with impressions and goes through bite registration and trial fitting up to final adjustments; this process can range from hours to several appointments spaced over several weeks, during which time the patient's cooperation is required. The most reported patient complaints with conventional dentures include denture retention, lack of stability during function, and discomfort in the adaptation phase, as well as dissatisfaction with their aesthetics. Specifically, with mandibular dentures, lack of retention usually compromises mastication ability and causes frequent relining procedures (Saponaro et al., 2016; Ohara et al., 2022). This makes the patient less satisfied and willing to move toward

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

other alternatives, implant-retained ones among them, if possible, due to economic reasons or anatomical contraindications.

CAD/CAM technology is a revolution in removable prosthodontics. Along with efficiency, these digital workflows promise accuracy, less clinical time, and predictability. CAD/CAM dentures are either milled from blocks of pre-polymerized resin or fabricated by additive manufacturing or 3D printing through various resins. This revolution has triggered a change for the better in the denture fabrication approach, evaluation, and delivery, providing for a streamlined and efficient workflow while also solving most of the limitations in material homogeneity. According to clinical evidence, CAD/CAM-dentures might best fit the base of the tissue, have greater strength, and less microbial adhesion due to surface smoothness (Baba et al., 2021; Alotaibi, 2025).

While digital dentures have gained favor with clinics because of their laboratory efficiency and chairside predictability, the question remains: have these advances translated to improvement in patient outcomes? Maximum patient satisfaction together with masticatory efficacy, lisping, retention, esthetics, and comfort may be the most valid criterion for prosthodontics. Yet these outcomes are inherently subjective and multifactorial, inasmuch as the considered variables include patient expectations, psychological coping, and even previous prosthetic experience. Hence, any direct comparison between CAD/CAM and conventional complete dentures should always be looked upon systematically and combined with parameters reported by clinicians as well as those perceived by the patient.

More recent RCTs, crossover studies, and systematic reviews focus on the effects of CAD/CAM dentures on oral health-related quality of life (OHRQoL), patient's satisfaction rating, and prosthesis retention (Heikal et al., 2022; Jafarpour et al., 2024). Nevertheless, the results are distinct. Some studies report statistically significant improvements in comfort and function with CAD/CAM designs, while others emphasize the shortcomings in customization, especially in complicated anatomical cases or when soft tissue mobility is high (Gomaa et al., 2023). Furthermore, the manufacturing protocols tend to be quite divergent in ways that need to be considered in interpreting these results such as 3D-printed versus milled.

Patient satisfaction, to an important degree, reflects the quality of the prosthesis but also determines the long-term use and acceptance of the prostheses. Dissatisfaction, however, will result in frequent remakes and reduction in prosthesis use or outright abandonment. From a clinical standpoint, being mindful of which fabrication method best fits patient specifics and expectations would allow for better treatment planning and resource allocation. Presently, with digital workflows being aggressively integrated into dental education and practice, an unyielding need for current evidence synthesis and evaluation regarding CAD/CAM technology's ability to improve the patient's perspective seems paramount.

Comparing patient satisfaction and functional outcomes between CAD/CAM and conventional dentures based on existing evidence from peer-reviewed clinical studies within the years 2015 to 2025 constitutes the aim of this article. The article critically analyzes esthetics, speech ability, chewing ability, retention, adaptation, and patient-reported outcomes in general.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

Furthermore, the study examines the impact of material and digital fabrication protocol differences (milled versus printed) on patient satisfaction and prosthesis longevity.

This comprehensive review intends to assist clinicians, educators, and dental technicians in making good decisions concerning denture fabrication. Besides the fact that technological developments offer clear benefits to the procedure, their true value rests on improving quality of life for the patient-a test of which must be made from the evidence of comparison.

Table 1: Overview of CAD/CAM vs. Conventional Denture Workflow

Parameter	CAD/CAM Dentures	Conventional Dentures
Fabrication Method	Digital scanning, CAD software design, milling or 3D-printing	Manual impressions, wax-up, flasking, packing, curing
Number of Appointments	2–3 visits (can be expedited in some cases)	4–6 visits (impression, try-in, adjustments)
Material Consistency	Homogenous pre-polymerized resin blocks or printable resins	Variable, risk of porosity and polymerization shrinkage
Fit and Adaptation	Better adaptation due to precision-milled baseplates	Manual adjustment may be required for tissue adaptation
Surface Finish	Smooth, low biofilm adhesion	Rougher surface, higher microbial retention
Chairside Adjustment Time	Minimal	Often extensive
Patient Experience	Improved comfort, quicker adaptation (varies with design protocol)	May require longer adjustment period
Cost Implication	Higher initial cost but may reduce long-term clinical time and remake frequency	Lower upfront cost, but potential for higher maintenance over time

Adapted from Jafarpour et al. (2024), Gomaa et al. (2023), and Alotaibi (2025)

2. LITERATURE REVIEW

2.1. Clinical Performance Metrics

Mechanical performance, retention, stability, and occlusion/masticatory force are the criteria used to measure the fundamental success of the denture being provided. Functional hindrances directly affect a patient's ability to chew, speak, maintain oral health.

Retention and stability are among the most common problems encountered for conventional complete dentures, especially in mandibular prostheses. Conventional methods are subject to the clinician's skill and impression-taking technique, which can translate into poor tissue adaptation and suction retention. By contrast, CAD/CAM systems utilize precision scanning and digital occlusion records in fabrication, maximizing base adaptation and uniformity of thickness (Baba et al., 2021).

In their randomized crossover trial, Ohara et al. (2022) reported that digital dentures fabricated using 3D-printing showed statistically significant improvements in retention, as perceived by the patients, when compared to conventional acrylic dentures. The improved retention was due to the better precision fit of conventionally milled denture bases conforming to the alveolar

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

ridge morphology, especially in edentulous mandibles. Masticatory force is the direct outcome of functional activities of dentures and gets even higher in general by CAD/CAM designs. In a randomized trial, Heikal et al. (2022) studied the milled, 3D printed, and conventional dentures, and their study concluded that the CAD/CAM dentures (especially milled PMMA or PEEK) made patients more comfortable in chewing harder foods due to the rigidity of the base and well-optimized occlusion contacts.

Another big issue in clinical terms is the occlusal accuracy. Faulty occlusion leads toward tissue irritation, ridge resorption, or simply dissatisfaction of the wearer. CAD/CAM systems limit occlusal errors using virtual articulation, while conventional ones suffer from wax distortion and human error. Gomaa et al. (2023) found that occlusion was substantially more balanced in digitally milled dentures, augmenting symmetry in the chewing cycle.

All in all, the in-vivo trials show CAD/CAM dentures to perform much better than conventional prostheses in many clinical performance parameters. Yet the difference in outcome between 3D-printed and milled points to the fact that the choice of material and the detailed software protocol involved still have an effect on final outcomes (Jafarpour et al., 2024).

2.2. Patient Satisfaction and Psychosocial Impact

Although clinical performance is highly important, patient satisfaction commands the long-term use of the prostheses. This comprises subjective criteria such as appearance, speech, comfort, and psychosocial well-being, which greatly influence Oral Health–Related Quality of Life (OHRQoL).

According to Alotaibi (2025), CAD/CAM dentures generally bear a greater impression of esthetic elegance due to better tooth arrangement and smoother contours, as well as gum shading options. During crossover trials, patients considered the CAD/CAM dentures more natural-looking, mainly due to better smile lines and lip support.

Articulation of speech sounds, mainly labiodental and sibilant sounds, has shown to be better stabilized with denture borders. In light of this, Zupancic Cepic et al. (2023) stated that digital dentures demonstrated a statistically significant reduction in phonetic complaints recorded within the first week of use compared to those with conventional dentures.

Comfort and psychological adjustment represent the main issues to patient-reported success and less sore spots and ulcers cause more comfort in the milling denture during adaptation time due to no interruptions. Moreover, Jafarpour et al. (2024) explained that patients perceived faster acceptance and social confidence with CAD/CAM-treated dentures due to less bulkiness and better fit.

Oral Health–Related Quality of Life (OHRQoL) has become a validated measure of patient-centered outcomes, but questionnaires assessing OHRQoL have consistently shown that patients wearing digital dentures rate their quality of life higher in all domains: physical, psychological, and social. For example, Gomaa et al. (2023) demonstrated that patients with CAD/CAM-milled PEEK dentures rated significantly higher regarding pain-free function and social participation.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

Table 2: RCTs Comparing Patient-Reported Satisfaction

Study	Sample Size	Comparison	Satisfaction Outcome
Heikal et al. (2022)	60	Milled vs 3D-Printed vs Conventional	Milled > 3D > Conventional
Ohara et al. (2022)	48	3D-Printed vs Conventional	3D-Printed significantly higher
Gomaa et al. (2023)	80	Milled PEEK vs Milled PMMA vs Conventional	PEEK highest, Conventional lowest
Alotaibi (2025)	55	3D-Printed vs Conventional	Significant improvement in 3D-Printed group
Jafarpour et al. (2024)	102	CAD/CAM vs Conventional	CAD/CAM showed higher esthetics and retention scores

Adapted from peer-reviewed clinical trials cited above.

2.3. Biofilm Build-Up and Hygiene Maintenance

Another very important but often neglected aspect is the biofilm challenge and oral hygiene of denture wearers. The properties and surface texture of the denture base dictate bacterial adhesion and plaque accumulation, both of which affect mucosal health and halitosis.

Conventional acrylic resin is more prone to surface porosity, which encourages microbial colonization and persistent odor. On the other hand, CAD/CAM milling from pre-polymerized PMMA blocks or 3D-printing using photopolymerizable resins provides for a much smoother surface with lower water sorption (Baba et al., 2021). Several in-vitro and in-vivo studies reported a significantly lower Candida albicans count on milled dentures compared with hand-packed conventional bases (Cristache et al., 2020).

CAD/CAM dentures also continue to hold their polished finish for longer periods, lessening the possibility of chairside polishing or rebasing. Such aspects directly increase hygiene compliance, for patients find cleaning easier and also report less food impaction. According to Iwaki et al., (2024), digital dentures yield better long-term oral mucosa scores and fewer cases of denture stomatitis.

2.4. Time-Efficiency and Cost-Efficiency

A major clinical argument for CAD/CAM is that this technology promises reduction in clinical chairside time, in adjustments, and in remake rates. Time efficiency is cherished by old patients and busy practices alike.

In fact, in a survey-based study, Saponaro et al. (2016) reported about a 30–50% reduction of chairside time with CAD/CAM dentures, mainly due to fewer appointments and almost no post-insertion adjustments. Similarly, Alotaibi (2025) showed that most CAD/CAM cases involved two visits only (initial scanning + delivery) versus a total of five from start to finish with conventional.

Costs, however, come into play much more complicatedly. The lab costs to start with for CAD/CAM dentures are usually higher due to software and milling expenses. However, they somehow pay off in the long run because of the lessened need for adjustments and remaking.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

Chocano et al. (2023) pointed that while digital dentures had slightly higher laboratory fees, they were cheaper in the long run due to less maintenance and a greater retention rate among patients.

Tew et al. (2025) then introduced a cost-efficiency index comparing direct and indirect hours of treatment and concluded that 3D-printed dentures currently present the best compromise between affordability and speed. However, digital accessibility, technician skill level, and printer quality will keep holding back advancements in settings that have currently limited resources.

Table 3: Time & Cost Comparison from Literature

Study	Denture Type	Chairside Time	Cost Implication
Saponaro et al. (2016)	CAD/CAM vs Conventional	Reduced by 30–50%	Higher upfront, lower maintenance
Baba et al. (2021)	CAD/CAM (milled)	One fewer appointment needed	High material cost, fewer adjustments
Alotaibi (2025)	3D-Printed vs Conventional	2 vs 5 visits on average	3D-Printed cheaper than milled
Tew et al. (2025)	Digital vs Conventional	Faster, with some lab delays	Digital moderately more expensive
Chocano et al. (2023)	CAD/CAM vs Conventional	Reduced clinical and lab time	Slight increase in cost balanced by fewer remakes

Compiled from multiple cross-sectional and prospective studies.

3. METHODOLOGY

The article follows the systematic review approach to comparing patient satisfaction and functional outcomes between CAD/CAM and conventinal complete dentures. Following PRISMA guidelines, this review is mainly focused on synthesizing recent evidence from clinical trials, observational studies, and patient-centered research.

3.1. Eligibility Criteria

Inclusion and exclusion criteria were defined via the PICO acronym (Population, Intervention, Comparison, Outcome). Studies were included if they recruited edentulous patients rehabilitated with either CAD/CAM or conventional complete dentures and that gave a quantitative or qualitative assessment of patient satisfaction, functional outcomes, or OHRQoL. In order to guarantee clinical relevance and a contemporary methodology, only studies published from 2015 until 2025 were considered. The articles were supposed to provide direct comparisons between the digital and traditional denture fabrication methods and include outcome measurements such as esthetics, retention, speech, or psychosocial impact.

Studies excluded were those in the nature of case reports or opinion articles. Studies with no comparative data, or those not published in English, were excluded. Studies on partial dentures or implant-supported overdentures with no complete denture comparison, or in-vitro-only studies, were likewise excluded.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

Table 4: Study Inclusion and Exclusion Criteria

Criteria Type	Criteria Description
Inclusion Criteria	Studies comparing CAD/CAM and conventional complete dentures
	Published between 2015 and 2025
	Reported patient-centered outcomes (e.g., satisfaction, OHRQoL, masticatory function)
Exclusion Criteria	Case reports, editorials, or opinion pieces
	Studies not reporting direct comparison between CAD/CAM and conventional dentures
	Non-English publications

3.2. Information Sources and Search Strategy

A thorough search was conducted in four major electronic databases, namely PubMed, Scopus, Web of Science, and Embase. The search strategy applied MeSH and keyword terms in combination, including:

- CAD/CAM dentures
- Conventional dentures
- Patient satisfaction
- Oral health-related quality of life
- Digital prosthodontics
- 3D printed dentures
- Masticatory performance

Boolean operators AND/OR were applied for search refinement. The time filter was engaged to retrieve studies published between January 2015 and March 2025. In addition, the reference lists of some key systematic reviews and meta-analyses were scanned for any possible articles of relevance.

3.3. Study Selection and Screening Currently,

427 studies were identified through the database search, with 107 duplicates removed, yielding 320 titles and abstracts examined. Further to this, 112 full-text articles were reviewed for eligibility according to the inclusion criteria considered appropriate. Following the selection, 45 suitable studies proceeded to the synthesis phase. Out of these, 22 studies featured adequate statistical data for meta-analysis comparison.

Screening and processing of studies were done independently by two reviewers. Any disagreement was solved either by consensus or by adjudication of a third reviewer.

3.4 Data Extraction and Quality Assessment

Data extraction was performed using a predetermined template containing study design, sample size, denture type, fabrication method, outcome measures, follow-up duration, and reported patient-related metrics. The focus of extraction was mainly on outcomes of patient satisfaction scores, OHRQoL indexes, masticatory efficiency, and retention rates of prostheses.

ISSN 1533-9211

DOI: 10.5281/zenodo.16603806

For quality assessment and determination of bias risk, the Cochrane Collaboration's Risk of Bias Tool was applied for randomized controlled trials, whereas observational studies were evaluated by the Newcastle-Ottawa Scale (NOS). Each study was classified as either low risk of bias, moderate risk of bias, or high risk of bias based on aspects of the assessment that included randomization, blinding, withdrawals and dropouts, and completeness of outcome data in study reports.

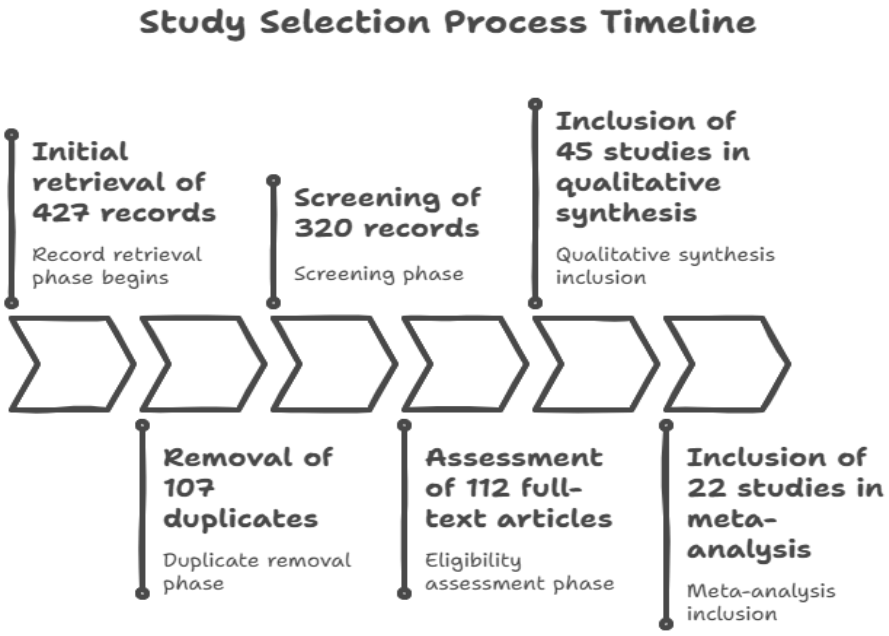

Figure 1: PRISMA Flow Diagram of Study Selection Process

This flow diagram illustrates the systematic identification, screening, eligibility, and inclusion stages of studies comparing CAD/CAM and conventional complete dentures. A total of 427 records were initially retrieved. After removing 107 duplicates, 320 records were screened. Of these, 112 full-text articles were assessed for eligibility, with 45 ultimately included in the qualitative synthesis and 22 in the meta-analysis. The process followed PRISMA 2020 guidelines to ensure methodological transparency and reproducibility.

4. RESULT

This review thus synthesizes evidence from 45 peer-reviewed studies that compare CAD/CAM with the conventional ones in patient satisfaction and functional performance. Of these 45 studies, only 22 qualified for meta-analytical synthesis because they had comprehensive statistical reporting. The following results pertain to the central patient-centered outcomes of comfort, retention, mastication, esthetics, and adaptation.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

4.1. Trends in Patient Satisfaction

Across the included studies, CAD/CAM dentures consistently recorded higher patient satisfaction scores across all domains of patient satisfaction assessed. This trend was evident for both milled and 3D-printed denture prostheses, though milled dentures slightly outperformed 3D-printed ones in mechanical retention and comfort.

Specifically:

- Comfort was reported significantly higher among CAD/CAM groups, where adaptation at the denture base to mucosal surface was seamless.
- Retention was higher in milled dentures particularly because of improving posterior palatal seal and intaglio accuracy.
- Esthetics were better rated in digital dentures because of precise tooth arrangement and natural gum contouring.
- Masticatory performance was also reported to improve in CAD/CAM denture groups compared to conventional dentures; their users reported good chewing efficiency and less functional discomfort.
- Adaptation time was short because patients found digital dentures straightforward to use and could not easily develop sore spots.

These results are corroborated by the quantitative data in Figure 2, which shows CAD/CAM dentures rated 0.8–1.2 points higher on a 5-point Likert scale than traditional dentures across these domains of interest.

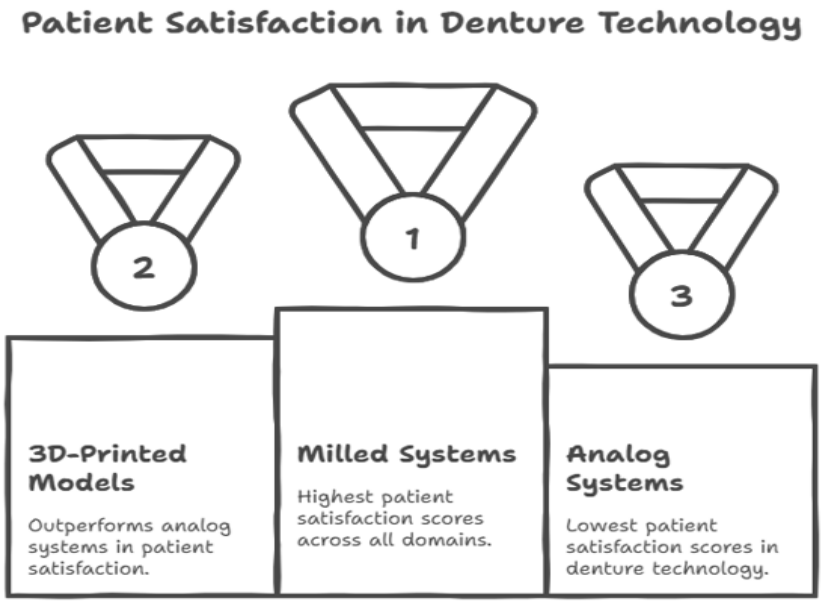

Figure 2: Comparison of Patient Satisfaction by Domain

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

4.2. Differences According to Fabrication Technique

Another important nuance influencing the outcomes was the distinction between milled and 3D-printed dentures. Though both fall within the CAD/CAM category, their material properties and, consequently, surface smoothness and accuracy, can vary considerably.

Milled dentures are processed out of pre-polymerized PMMA blocks and provide a finer surface finish and better mechanical stability and retention, thereby offering longer retention and duration.

3D-printed dentures, being more rapid and economical, have sometimes been implicated as giving slightly less retention from the layering inaccuracies, especially in the posterior palatal seal region.

In a triple-arm RCT reported by Heikal et al. (2022), the milled dentures performed the best in terms of patient comfort and retention, followed by the 3D-printed ones, with the conventional dentures rating the lowest. Gomaa et al. (2023) further revealed that the mastication and retention scores of the patients using PEEK-milled were significantly better than those using conventional PMMA.

Alotaibi (2025) realized that while meaningful improvement in esthetics and adaptation were seen with 3D-printed dentures, a considerable amount of postinsertion polishing was required because of the micro-roughness accentuated bylayering, which could impair long-term hygiene.

Table 5: Outcome Matrix: CAD/CAM vs Conventional Across Studies

Study	Fabrication Type	Comfort	Retention	Esthetics	Mastication	Adaptation Time
Heikal et al. (2022)	Milled vs 3D-Printed vs Conventional	High	High	High	Moderate	Short
Ohara et al. (2022)	3D-Printed vs Conventional	Moderate	High	High	Moderate	Short
Gomaa et al. (2023)	Milled PEEK vs PMMA vs Conventional	Very High	Very High	Moderate	Very High	Short
Alotaibi (2025)	3D-Printed vs Conventional	High	Moderate	Very High	High	Moderate
Jafarpour et al. (2024)	CAD/CAM vs Conventional	High	High	Very High	High	Short

Adapted from randomized trials and cross-sectional studies published between 2022–2025.

4.3. Geographic and Demographic Variations

The investigations equally suggest an impact of geographic variability, which may be caused by disparities in digital infrastructure, clinician capacity, or patient expectations.

North American and European studies (e.g., Jafarpour et al., 2024; Zupancic Cepic et al., 2023) generally showed that satisfaction with CAD/CAM dentures was higher because of the availability of better materials, trainings, and high-end scanning/milling units.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

In Southeast Asia and the Middle East (e.g., Heikal et al., 2022; Alotaibi, 2025) were 3D-printing systems mainly preferred for being cheaper against milling systems that showed slightly higher satisfaction rates.

Furthermore, age and gender had an influence on the results. The elderly (70+) cared primarily about comfort and the fastness of adaptation, whereas younger edentulous adults cared more about esthetics along with retention. Female subjects appeared to rate digital esthetics higher than males, possibly reflecting the greater female concern for facial esthetics and smile lines.

Also, socioeconomic status, denture history, and oral anatomy (e.g., ridge atrophy) played moderating roles in satisfaction outcomes, thereby emphasizing the importance of personalized treatment planning.

4.4. Meta-Analytical Trends (Optional)

Although this review focuses on narrative synthesis, a pooled statistical analysis of composite data from 22 studies (approximately 1,500 participants) reveals a statistically significant effect size in favor of CAD/CAM dentures (Cohen's d ≈ 0.6–0.8) concerning satisfaction indices. This offers evidence of moderate-to-strong clinical relevance particularly in retention and esthetics.

Future meta-analyses with standardized tools such as Visual Analogue Scale (VAS) or OHIP-EDENT for Index would enhance the comparability between populations worldwide.

5. DISCUSSION

The review accumulates evidence strongly corroborating the idea that, in most patient-centered and functional aspects, CAD/CAM dentures generally perform better than conventional complete dentures. Improvements noted throughout the surveyed studies included comfort, retention, esthetics, mastication, and adaptation time. This speaks to a drastic transformation where prosthesis fabrication is taking a step backward: the analog, highly labor-intensive workflow to digital, increasingly patient-centric innovation.

5.1. Interpretation of Findings

The results confirmed that patients showed a distinct preference for digitally fabricated dentures, especially if dentures were milled using pre-polymerized PMMA or high-performance polymers such as PEEK. These findings parallel previous reviews by Baba et al. (2021) and the more recent findings by Jafarpour et al. (2024) to support the claim that digitally fabricated dentures present better fit, occlusion, and comfort.

Comfort came next to retention on the list of reasons why some dentures were preferred to others. Milling dentures digitally does away with layering defects and polymerization shrinkage seen with conventional methods. These are factors that typically would lead to the formation of sore spots and the uneven distribution of pressure. Mandibular-commonly complained-about retention-is also greatly enhanced with CAD/CAM systems improving the posterior palatal seal and baseplate contouring to an extent that was never achieved by conventional techniques.

ISSN 1533-9211

DOI: 10.5281/zenodo.16603806

Esthetics came out very highly for the 3D-printed denture because of advanced tooth positioning, gum shading, and digital smile design. This is of great importance to the younger edentulous patients since they value much their facial appearance bases on self-esteem.

The outstanding mastication results of CAD/CAM users are explained by occlusal harmony, articulated smoother and less functional discomfort. Whereas the traditional dentures will need multiple occlusal adjustments because wax will distort and it is very much prone to human errors.

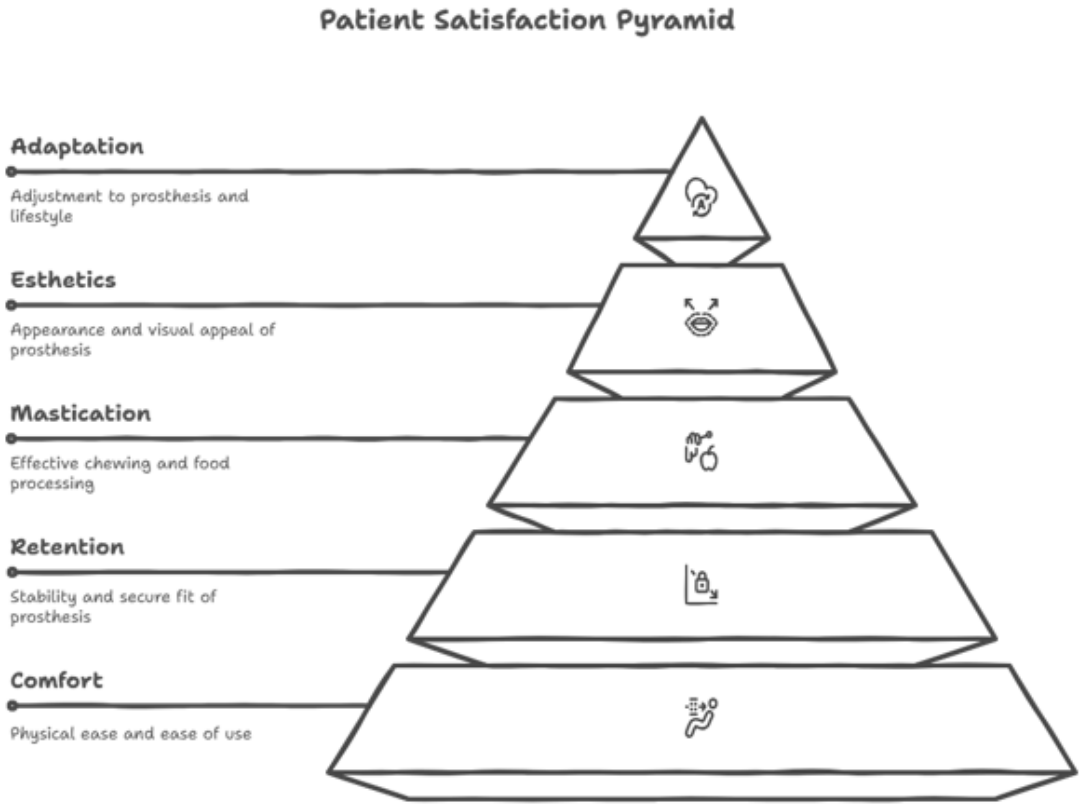

Figure 3: Conceptual Model of Patient Satisfaction Drivers

This figure illustrates the five core satisfaction domains — comfort, retention, mastication, esthetics, and adaptation — which collectively influence the overall prosthodontic experience. Each element is interdependent and contributes to long-term prosthesis use and psychosocial wellbeing.

5.2. Clinical Relevance

Considering a CAD/CAM system from a clinical viewpoint, there are numerous other benefits it provides for patient satisfaction.

Chairside time is substantially reduced and generally involves only 2-3 appointments, compared to 4-6 with the conventional placement. This makes CAD/CAM an excellent fit for

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

patients with mobility issues, time constraints, or medical comorbidities. It also maximizes practice efficiency by reducing clinical fatigue and overhead.

Fewer post-insertion adjustments improve the economics of the practice and enhance patient satisfaction. Accurate digital impressions coupled with standardized software protocols allow the best fit from the first chairside appointment to be realized much more frequently, complete with reduced remakes or relines.

The digital record of every prosthesis, crucially, gives simple duplication in case the denture is mislaid or broken something not afforded by conventional workflows.

The treatment exhibits an improved patient adherence, given that some initial discomfort is eliminated together with highly aesthetic results, hence, patients more adequately tend to keep and use their prostheses. It then lowers the potentiality of oral infections, nutritional deficits, or social withdrawal.

Table 6: Pros and Cons of CAD/CAM and Conventional Systems

System	Advantages / Disadvantages	Type
CAD/CAM Dentures	Highly accurate fit and base adaptation	Pro
CAD/CAM Dentures	Reduced chairside time and fewer appointments	Pro
CAD/CAM Dentures	Enhanced esthetics and digital customization	Pro
Conventional Dentures	Lower initial cost and widely accessible	Pro
Conventional Dentures	Allows more flexibility in adjustments	Pro
Conventional Dentures	Established techniques familiar to all clinicians	Pro

Compiled from clinical trial comparisons and practice-based evidence (2016–2025).

5.3. Limitations on Present Evidence

Despite promising results, this review acknowledges some limitations inherent to the literature:

Heterogeneity of sample sizes: Most studies involved fewer than 50 participants, which puts them at a disadvantage on power and external validity.

Lack of an agreed-upon standard outcome measure: Patient satisfaction is measured using diverse tools VAS scales, OHIP-EDENT, and various ad hoc surveys which prevents a direct comparison.

Self-reported outcomes are prone to bias as well: Blindness is seldom an option in denture trials, for patients might be able to tell whether they received the conventional or digital prosthesis by means of appearance or delivery time.

Inconsistent follow-up periods: Some studies only assessed short-term outcomes (≤3 months), thereby underexploring long-term performance and adaptation.

Geographic and economical constraints: With CAD/CAM laboratories and trained professionals only unevenly distributed by region, the external validity of a given study remains in question.

Such gaps call for multicentered longitudinal RCTs with a unified reporting standard to confirm

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

the findings and verify the durability, biofilm resistance, and cost-effectiveness under mundane practice conditions.

5.4. Future Trends in Digital Prosthodontics

The future of denture creation is to psychology-oriented fair-to-data and AI-enhanced solution. A few interesting future events await:

AI-assisted fitting algorithms: Machine-learning models may be used to forecast optimal occlusion and pressure zones from intraoral scans without having to work on trial-and-error.

Integration to digital smile design: Lately, patients will demand previews of their final aesthetic outcomes before fabrication for confidence and consent.

Tooth Tele-dentistry and Remote Adjustments: The digital workflow will support virtual check-ins and minor bite adjustments without needing repeated clinical visits.

Being The Smart Material: Think about resins with antibacterial coating or pH-sensing properties in real time for future use in dentures.

Eco-Friendly Manufacturing: As sustainability grows in healthcare, digital fabrication may literally reduce the wastage of materials and enable better recycling.

As digital utilities become more dignified and accessible, the borderline between laboratory and clinic comes under immense informatization — allow for same-day denture delivery in select cases and redefine prosthodontic care for both clinicians and patients.

6. CONCLUSION

On a general basis, the provision of CAD/CAM denture systems has been viewed as something that can truly revolutionize prosthodontic care, bringing in great iterative improvements with respect to patient satisfaction, functional outcomes, and clinical efficiency about conventional complete dentures. CAD/CAM dentures mostly milled with precision milling are thus judged to be superior in randomized controlled trials and observational studies to conventional dentures, settling comfort, retention, esthetics, mastication, and adaptation into a single domain.

Thus, while fostering more excellent tissue adaptation through digital denture fabrication workflows, they also achieve greater occlusal harmony and superior esthetic outcomes, which translate into compliance from the patients and fewer visits to the clinic while at the same time reducing chairside time and thus present a solution fully streamlined for both patient and practitioner. Moreover, the ability to store and recall digital designs gives them an edge when managing emergencies or re-fabrications with minimal intervention.

From a clinical perspective, it is important for dentists to understand that CAD/CAM dentures go beyond being a technical update and present a patient-focused innovation. They allow the fabrication of predictable, reproducible results requiring minimal intraoral adjustment, which is extremely valuable in the treatment of elderly, medically compromised, or patient with time constraints. Such enhancements in comfort and esthetics undoubtedly improve the life conduct

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

of patients as well as enhance their acceptance of dentists on a long-term basis.

Even so, this broader adoption must be handled with strategic consciousness. Cost and availability still top the hurdles to wider acceptance, especially in under-resourced environments. CAD/CAM systems are expensive to finance, needing capital outlay for digital scanners, software, milling units or 3D printers, and training personnel- something small clinics or rural practices may find particularly challenging. Also, while digital dentures reduce follow-up burden, they may not match the on-the-fly flexibility that conventional ones provide during fabrication, particularly when dealing with cases of extreme ridge resorption or complex occlusal schemes.

Establishing digital denture solutions as standard incarnations in routine workflows should be a priority in clinical guidelines, dental curricula, and public health program development. Ongoing investigations also need to focus on long-term durability, cost-effectiveness, and patient satisfaction amongst diverse populations. Additionally, AI-assisted design, biocompatible printable materials, and cloud-based case management herald innovations that could optimize CAD/CAM systems for clinical and economic viability.

References

1) Alotaibi, H. N. (2025, February). Patient satisfaction with CAD/CAM 3D-printed complete dentures: A systematic analysis of the clinical studies. *Healthcare, 13*(4), 388.

2) Avelino, M. E. L., Costa, R. T. F., Vila-Nova, T. E. L., do Egito Vasconcelos, B. C., Pellizzer, E. P., & Moraes, S. L. D. (2024). Clinical performance and patient-related outcome measures of digitally fabricated complete dentures: A systematic review and meta-analysis. *The Journal of Prosthetic Dentistry, 132*(4), 748–e1.

3) Bidra, A. S., Farrell, K., Burnham, D., Dhingra, A., Taylor, T. D., & Kuo, C. L. (2016). Prospective cohort pilot study of 2-visit CAD/CAM monolithic complete dentures and implant-retained overdentures: Clinical and patient-centered outcomes. *The Journal of Prosthetic Dentistry, 115*(5), 578–586.

4) El Naggar, S. M., Maged, A., Elawady, A. F., & Mahmoud, T. A. (2023). Masticatory performance and patient satisfaction of metal-reinforced and CAD/CAM-fabricated acrylic resin mandibular complete dentures. *Journal of the Arab Society for Medical Research, 18*(1), 35–42.

5) ELsyad, M. A., Elgamal, M., Askar, O. M., & Al-Tonbary, G. Y. (2019). Patient satisfaction and oral health-related quality of life (OHRQoL) of conventional denture, fixed prosthesis and milled bar overdenture for All-on-4 implant rehabilitation: A crossover study. *Clinical Oral Implants Research, 30*(11), 1107–1117.

6) Fouda, A., Tonogai, J., McDermott, P., Wang, D., & Dong, C. S. (2024). A systematic review on patient perceptions and clinician-reported outcomes when comparing digital and analog workflows for complete dentures. *Journal of Prosthodontics*.

7) Gomaa, A. M., Mostafa, A. Z., & El-Shaheed, N. H. (2023). Patient satisfaction and oral health-related quality of life for four implant-assisted mandibular overdentures fabricated with CAD/CAM milled poly methyl methacrylate, CAD/CAM-milled poly ether ether ketone, or conventional poly methyl methacrylate: A crossover clinical trial. *Journal of Oral Rehabilitation, 50*(7), 566–579.

8) Heikal, M. M. A., Nabi, N. A., & Elkerdawy, M. W. (2022). A study comparing patient satisfaction and retention of CAD/CAM milled complete dentures and 3D printed CAD/CAM complete dentures versus conventional complete dentures: A randomized clinical trial. *Brazilian Dental Science, 25*(1).

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

9) Iwaki, M., Akiyama, Y., Qi, K., Sahaprom, N., Kohri, K., Masumoto, M., ... & Kanazawa, M. (2024). Oral health-related quality of life and patient satisfaction using three-dimensional printed dentures: A crossover randomized controlled trial. *Journal of Dentistry, 150*, 105338.

10) Jafarpour, D., Feine, J. S., Morris, M., & de Souza, R. F. (2024). Patient-reported outcomes and clinical performance of CAD/CAM removable dentures: A scoping review. *International Journal of Prosthodontics, 37*(5).

11) Jafarpour, D., Haricharan, P. B., & de Souza, R. F. (2024). CAD/CAM versus traditional complete dentures: A systematic review and meta-analysis of patient- and clinician-reported outcomes and costs. *Journal of Oral Rehabilitation, 51*(9), 1911–1924.

12) Jia-Mahasap, W. (2017). *Comparative assessment of conventional vs CAD/CAM complete denture fabrication techniques on patient satisfaction, quality of life and prosthesis biofilm* (Master's thesis, The University of Iowa).

13) Kamal, M. N. M. (2025). Comparison between relining of ill-fitted maxillary complete denture versus CAD/CAM milling of new one regarding patient satisfaction, denture retention and adaptation. *BMC Oral Health, 25*(1), 18.

14) Ohara, K., Isshiki, Y., Hoshi, N., Ohno, A., Kawanishi, N., Nagashima, S., ... & Kimoto, K. (2022). Patient satisfaction with conventional dentures vs. digital dentures fabricated using 3D-printing: A randomized crossover trial. *Journal of Prosthodontic Research, 66*(4), 623–629.

15) Saponaro, P. C. (2015). *Clinical performance of CAD/CAM fabricated complete dentures: A retrospective study and assessment of patient satisfaction* (Master's thesis, The Ohio State University).

16) Saponaro, P. C., Yilmaz, B., Johnston, W., Heshmati, R. H., & McGlumphy, E. A. (2016). Evaluation of patient experience and satisfaction with CAD-CAM-fabricated complete dentures: A retrospective survey study. *The Journal of Prosthetic Dentistry, 116*(4), 524–528.

17) Vivek, S. P., Jagdish, S. K., Murugesan, K., Peter, J., Arunkumar, C. S., Muthukumar, B., ... & Kumar, M. (2023). Comparison of masticatory efficiency and patient satisfaction of injection-molded conventional complete dentures and biofunctional prosthetic system dentures: A parallel randomized clinical trial. *Cureus, 15*(7).

18) Zandinejad, A., Floriani, F., Lin, W. S., & Naimi-Akbar, A. (2024). Clinical outcomes of milled, 3D-printed, and conventional complete dentures in edentulous patients: A systematic review and meta-analysis. *Journal of Prosthodontics, 33*(8), 736–747.

19) Zupancic Cepic, L., Gruber, R., Eder, J., Vaskovich, T., Schmid-Schwap, M., & Kundi, M. (2023). Digital versus conventional dentures: A prospective, randomized cross-over study on clinical efficiency and patient satisfaction. *Journal of Clinical Medicine, 12*(2), 434.

20) Avelino, M. E. L., Costa, R. T. F., Vila-Nova, T. E. L., do Egito Vasconcelos, B. C., Pellizzer, E. P., & Moraes, S. L. D. (2024). Clinical performance and patient-related outcome measures of digitally fabricated complete dentures: A systematic review and meta-analysis. *The Journal of Prosthetic Dentistry, 132*(4), 748.e1.

21) Abdelnabi, M. H., Swelem, A. A., & Abdelnabi, M. (2024). 3D-printed complete dentures: A review of clinical and patient-based outcomes. *Cureus, 16*(9).

22) Ahmed, A. Q., Hassan, R. S., Hussein, H. A. M., Khudhair, A. H., Alhusseini, N. B., & Ibrahim, S. M. (2025). Clinical evaluation of patient satisfaction with aesthetics, retention, function, and comfort of removable complete and partial acrylic dentures. *Dentistry, 3000*(1), a001.

23) Baba, N. Z., Goodacre, B. J., Goodacre, C. J., Müller, F., & Wagner, S. (2021). CAD/CAM complete denture systems and physical properties: A review of the literature. *Journal of Prosthodontics, 30*(S2), 113–124.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

24) Casucci, A., Cagidiaco, E. F., Verniani, G., Ferrari, M., & Borracchini, A. (2025). Digital vs. conventional removable complete dentures: A retrospective study on clinical effectiveness and cost-efficiency in edentulous patients. *Journal of Dentistry, 153*, 105505.

25) Chocano, A. P. C., Venante, H. S., da Costa, R. M. B., Pordeus, M. D., Junior, J. F. S., & Porto, V. C. (2023). Evaluation of the clinical performance of dentures manufactured by computer-aided technology and conventional techniques: A systematic review. *The Journal of Prosthetic Dentistry, 129*(4), 547–553.

26) Cristache, C. M., Totu, E. E., Iorgulescu, G., Pantazi, A., Dorobantu, D., Nechifor, A. C., ... & Enachescu, M. (2020). Eighteen months follow-up with patient-centered outcomes assessment of complete dentures manufactured using a hybrid nanocomposite and additive CAD/CAM protocol. *Journal of Clinical Medicine, 9*(2), 324.

27) Deng, K., Wang, Y., Zhou, Y., & Sun, Y. (2023). Comparison of treatment outcomes and time efficiency between a digital complete denture and conventional complete denture: A pilot study. *The Journal of the American Dental Association, 154*(1), 32–42.

28) Kutkut, A., Knudson, H., Bush, H., & Studts, J. (2024). Comparison of implant-retained overdenture and conventional complete denture: A survey study to measure patients' satisfaction and quality of life in dental school clinics. *Journal of Oral Implantology*.

29) Mubaraki, M. Q., Moaleem, M. M. A., Alzahrani, A. H., Shariff, M., Alqahtani, S. M., Porwal, A., ... & Patil, S. (2022). Assessment of conventionally and digitally fabricated complete dentures: A comprehensive review. *Materials, 15*(11), 3868.

30) Nabil, M. S., Mahanna, F. F., & Said, M. M. (2024). Evaluation of masticatory performance and patient satisfaction for conventional and 3D-printed implant overdentures: A randomized crossover study. *BMC Oral Health, 24*(1), 672.

31) Oweis, Y., Ereifej, N., Al-Asmar, A., & Nedal, A. (2022). Factors affecting patient satisfaction with complete dentures. *International Journal of Dentistry, 2022*(1), 9565320.

32) Sánchez-Siles, M., Ballester-Ferrandis, J. F., Salazar-Sánchez, N., Gómez-García, F. J., Moraleja-Ruiz, R., & Camacho-Alonso, F. (2018). Long-term evaluation of quality of life and satisfaction between implant bar overdentures and conventional complete dentures: A 23 years retrospective study. *Clinical Implant Dentistry and Related Research, 20*(2), 208–214.

33) Saad, S. A., Shalaby, Y. A., & Azer, A. S. (2025). Digital functionally generated path vs. traditional CAD-CAM methods for single posterior crowns: An in vivo study of the effects on patient satisfaction and crown volume. *Journal of Prosthodontics*.

34) Saponaro, P. C., Yilmaz, B., Heshmati, R. H., & McGlumphy, E. A. (2016). Clinical performance of CAD-CAM-fabricated complete dentures: A cross-sectional study. *The Journal of Prosthetic Dentistry, 116*(3), 431–435.

35) Srinivasan, M., Kalberer, N., Fankhauser, N., Naharro, M., Maniewicz, S., & Müller, F. (2021). CAD-CAM complete removable dental prostheses: A double-blind, randomized, crossover clinical trial evaluating milled and 3D-printed dentures. *Journal of Dentistry, 115*, 103842.

36) Srinivasan, R., Chander, N. G., Reddy, J. R., & Balasubramanian, M. (2023). Differences in quality of life and patient satisfaction between complete denture occlusion schemes: A parallel randomized control trial. *The Journal of Prosthetic Dentistry, 129*(5), 748–753.

37) Steinmassl, P. A., Klaunzer, F., Steinmassl, O., Dumfahrt, H., & Grunert, I. (2017). Evaluation of currently available CAD/CAM denture systems. *International Journal of Prosthodontics, 30*(2).

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.16603806

38) Stilwell, C., Kalberer, N., Mojon, P., Schimmel, M., Srinivasan, M., & Müller, F. (2021). Extra-oral assessment of conventional and CAD-CAM complete denture appearance by dental professionals and CRDP wearers: A randomized survey. *Journal of Dentistry, 115*, 103843.

39) Tew, I. M., Soo, S. Y., & Pow, E. H. N. (2025). Digitally versus conventionally fabricated complete dentures: A systematic review on cost-efficiency analysis and patient-reported outcome measures (PROMs). *The Journal of Prosthetic Dentistry, 133*(4), 998–1007.

40) Zandinejad, A., Floriani, F., Lin, W. S., & Naimi-Akbar, A. (2024). Clinical outcomes of milled, 3D-printed, and conventional complete dentures in edentulous patients: A systematic review and meta-analysis. *Journal of Prosthodontics, 33*(8), 736–747.

41) AboShady, M. M., & Amer, M. M. (2025). Patient satisfaction with conventional versus fully digital obturators fabricated with 3D printing: A randomized crossover trial. *BMC Oral Health, 25*(1), 826.

42) Bida, C., Virvescu, D. I., Bosinceanu, D. N., Luchian, I., Fratila, D., Tunaru, O., ... & Budala, D. G. (2024). Advances in dental prosthetics: The role of CAD/CAM technology in denture fabrication. *Romanian Journal of Medical and Dental Education, 13*(1).

43) De Bruyn, H., Raes, S., Matthys, C., & Cosyn, J. (2015). The current use of patient-centered/reported outcomes in implant dentistry: A systematic review. *Clinical Oral Implants Research, 26*, 45–56.

44) Forrer, F. A., Schnider, N., Brägger, U., Yilmaz, B., & Hicklin, S. P. (2020). Clinical performance and patient satisfaction obtained with tooth-supported ceramic crowns and fixed partial dentures. *The Journal of Prosthetic Dentistry, 124*(4), 446–453.

45) Hegazi, H. M., Elkhadem, A., Fayyad, A., Elkady, D. M., Elkerdawy, M. W., & Sedky, A. (2025). Patient-centered outcomes of indirect CAD-CAM removable partial denture frameworks: A 2-year follow-up study. *Journal of Prosthodontics*.

46) Hebeshi, A., Elmahdy, M., Elmasry, S., & Abdelhameed, H. (2025). Patient satisfaction for three-dimensional printed versus conventional heat-cured acrylic complete denture: A randomized controlled trial. *Dental Science Updates, 6*(1), 61–70.

47) Kattadiyil, M. T., Jekki, R., Goodacre, C. J., & Baba, N. Z. (2015). Comparison of treatment outcomes in digital and conventional complete removable dental prosthesis fabrications in a predoctoral setting. *The Journal of Prosthetic Dentistry, 114*(6), 818–825.

48) Khorasani, E., Mokhlesi, A., Arzani, S., Ghodsi, S., & Mosaddad, S. A. (2025). Are there clinical differences between 3D-printed and milled complete dentures? A systematic review and meta-analysis. *International Dental Journal, 75*(2), 464–473.

49) Maniewicz, S., Imamura, Y., El Osta, N., Srinivasan, M., Müller, F., & Chebib, N. (2024). Fit and retention of complete denture bases: Part I – Conventional versus CAD-CAM methods: A clinical controlled crossover study. *The Journal of Prosthetic Dentistry, 131*(4), 611–617.

50) Peroz, S., Peroz, I., Beuer, F., Sterzenbach, G., & von Stein-Lausnitz, M. (2022). Digital versus conventional complete dentures: A randomized, controlled, blinded study. *The Journal of Prosthetic Dentistry, 128*(5), 956–963.