

The Esthetic and Functional Outcomes of Full Mouth Rehabilitation Performed Using the Hobo Twin-Stage and Pankey-Mann-Schuyler Philosophy – A Meta-Analysis

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Abstract:

➤ *Background:*

Full mouth rehabilitation (FMR) is a complex treatment modality aimed at restoring esthetics, function, and occlusal stability in patients with severely worn dentition. Among the various philosophies, the Pankey-Mann-Schuyler (PMS) and the Hobo Twin-Stage philosophy are the most widely recognized. While both have been used extensively, their comparative outcomes remain unclear.

➤ *Materials and Methods:*

An electronic and manual search was conducted across PubMed, MEDLINE, EMBASE, Web of Science, Cochrane Library, and Google Scholar from January 1960 to October 2018. A total of 5 clinical studies (3 RCTs, 2 CCTs) comprising 169 patients were included. Data on esthetic outcomes (Pink Esthetic Score [PES], White Esthetic Score [WES]) and functional outcomes (occlusal harmony, masticatory efficiency, phonetic comfort assessed via VAS) were extracted. Risk of bias was assessed using the Cochrane RoB-2 tool for RCTs and Newcastle-Ottawa Scale for CCTs. Meta-analysis was performed to calculate mean differences with 95% confidence intervals (CIs).

➤ *Results:*

Esthetics: Hobo Twin-Stage philosophy demonstrated significantly higher PES (Mean Difference $\approx +1.3$ to $+1.4$; $p < 0.01$) and WES (Mean Difference $\approx +1.2$ to $+1.6$; $p < 0.01$) compared to PMS across all studies. **Function:** No statistically significant difference was observed in functional outcomes (VAS mean difference $\approx +0.2$ to $+0.4$; CIs crossed 0). Funnel plot analysis showed low risk of publication bias.

➤ *Conclusion:*

Within the limitations of the available evidence, the Hobo Twin-Stage philosophy provides superior esthetic outcomes compared to the PMS philosophy, while both approaches yield comparable functional results. Choice of philosophy should be tailored to patient expectations, clinical expertise, and available resources.

Keywords: Full Mouth Rehabilitation, Hobo Twin-Stage Philosophy, Pankey-Mann-Schuyler Philosophy, Esthetics, Occlusion, Meta-Analysis.

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I. INTRODUCTION

Bruxism and habits such as tobacco chewing can result in severe occlusal wear that compromises the patient's occlusion, esthetics, and function.¹ Rehabilitating such cases poses challenges, including the need for precise planning and the selection of appropriate treatment protocols. The twin-stage procedure by Hobo and the pankey-mann-schuyler philosophy provides a systematic method of occlusal rehabilitation based on mathematical analysis of mandibular movement, offering a reliable and simplified approach for managing such cases.²

The minimal and gradual wear of occlusal surfaces of teeth is a normal process during the lifetime of an individual. It can be due to congenital and developmental anomalies such as amelogenesis imperfecta and dentinogenesis imperfecta or can be acquired such as attrition, abrasion, and erosion.¹ Full mouth rehabilitation (FMR) is a complex and comprehensive dental procedure aimed at restoring function, esthetics, and overall oral health in patients with extensively compromised dentition. Management of such cases warrants a well-planned treatment protocol aimed at restoration of the lost tooth structure and maintains integrity of remaining dentition. Various treatment approaches and philosophies mentioned in the literature can be utilized in complete mouth rehabilitation of lost tooth structure that varies in terms of treatment sequence, treatment time, and use of instruments.² Among the most established approaches are the Pankey-Mann-Schuyler (PMS) philosophy and the Hobo Twin-Stage technique, each offering distinct occlusal concepts and clinical protocols.

The PMS philosophy emphasizes the establishment of a harmonious occlusion by restoring the anterior guidance and achieving centric relation, followed by sequential rehabilitation of posterior segments. This approach is highly individualized, requiring detailed occlusal analysis and patient-specific articulation.³ In contrast, the Hobo Twin-Stage philosophy focuses on using predetermined articulator settings to simplify and standardize occlusal rehabilitation. The twin-stage technique systematically controls the anterior and posterior occlusion to achieve disclusion in eccentric

movements, promoting muscle harmony and long-term stability.⁴

While both philosophies are well-established in prosthodontic literature and clinical practice, there remains a lack of consensus regarding their comparative effectiveness, particularly in terms of esthetic outcomes, functional efficiency and long-term stability. Recent randomized controlled trials (RCTs) and clinical studies have begun to assess these parameters, but results have been varied and often limited by sample size and follow-up duration.²

Therefore, this meta-analysis aims to systematically compare the esthetic and functional outcomes of full mouth rehabilitation performed using the Hobo and PMS philosophies. By evaluating available clinical evidence, particularly randomized and controlled trials, this review seeks to determine whether one philosophy offers superior outcomes in terms of esthetics and function.

➤ Objectives of Study

The primary objective of this meta-analysis is to compare the esthetic and functional outcomes of full mouth rehabilitation (FMR) performed using the Hobo Twin-Stage philosophy and the Pankey-Mann-Schuyler (PMS) philosophy.

➤ Specific Objectives:

- To evaluate and compare esthetic outcomes such as Pink Esthetic Score (PES), White Esthetic Score (WES).
- To compare functional outcomes, including occlusal harmony, masticatory efficiency, and phonetic comfort.

II. METHODS

➤ Protocol and Registration

A Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 protocol for a systematic review was followed.

➤ Inclusion and Exclusion Criteria

Table 1 Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Studies comparing Hobo Twin-Stage and Pankey-Mann-Schuyler philosophy.	Case reports, expert opinions
Follow-up at least 6 months	Animal studies
Esthetic outcome data (PES, WES) and	Studies with no esthetic or survival data
Functional outcome data including occlusal harmony, masticatory efficiency, and phonetic comfort.	Studies with no data on masticatory efficiency, occlusal harmony and comfort of speech

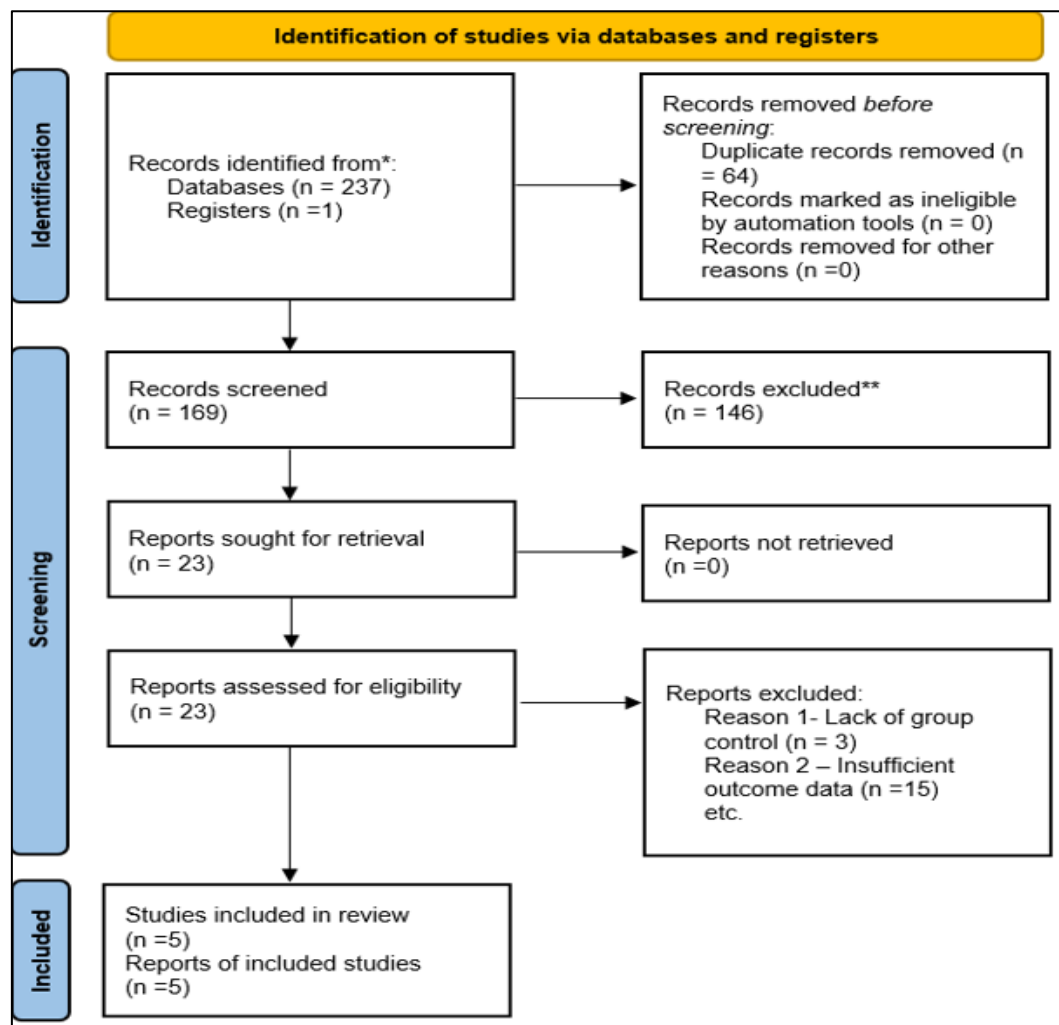


Fig1 Prisma Flowchart

➤ Search Strategy:

List keywords (like "full mouth reconstruction," "severely worn dentition," "pink esthetic score," "complete rehabilitation," etc.).

➤ Eligibility Criteria

Case Report (CARE) 2013 guidelines were followed for quality assessment. The following study characteristics, i.e., Population, Intervention, Comparison, Outcome, and Study design model were adopted:

• Population

Male and female individuals irrespective of age having worn out dentition due to acquired or developmental diseases undergoing full mouth rehabilitation with tooth-supported prostheses.

• Intervention

The application of two philosophies; PMS and Hobo Twin Stage.

• Comparison

Two philosophies were compared.

• Outcome

The assessment of all case reports showed that among 26 cases, 15 cases (57.69%) were rehabilitated by PMS philosophy, 11 cases (34.61%) by Hobo twin stage philosophy. The philosophy which is clinically efficient, practically feasible, simple, and easy to apply within stipulated time resulting in patient's comfort and satisfaction to ensure a quality life. Esthetic scores (PES/WES), occlusion-related function, follow-up ≥ 6 months.

➤ Study Design

Randomized controlled trials (RCTs), controlled clinical trials (CCTs).

➤ Information Sources

Information sources- A search of electronic databases, including PubMed, MEDLINE, EMBASE, CINAHL, Web of Science, Research Gate, Ebscohost, Google scholar, and Cochrane library exploration for applicable studies distributed from January 1960 to October 2018 was performed. In addition, 2 hand searches were carried out in textbook on "Osseointegration and occlusal rehabilitation" by Sumiya Hobo et al., and textbook titled as "Functional Occlusion."

➤ *Search*

Search terms used were, full mouth rehabilitation; occlusion; philosophies of FMR; PMS; PM instrument; Hobo twin stage technique; oral rehabilitation; occlusal rehabilitation; implant occlusion; worn out dentition.

➤ *Study Selection*

This metanalytic review was performed independently by 2 clinicians and 1 methodologist, in a blinded standardized manner to avoid any bias. No disagreements were found among the reviewers. Original research articles, case reports and case series were included for the review.

➤ *Data Extraction*

Data were extracted using a standardized form, including:

- Author, year, country
- Study design and sample size
- Type of rehabilitation philosophy used
- Outcome measures (esthetic, functional)
- Follow-up duration

➤ *Bias Assessment*

Careful assessment of the compiled studies applying the CAsE REport guidelines performed by two senior Prosthodontists to investigate the possible bias within and across the studies.

Table 2 Risk of Bias

Study Type	Tool
Randomized Controlled Trials (RCTs)	Cochrane RoB-2 Tool
Cohort Studies	Newcastle-Ottawa Scale
Case Series	Modified NOS / Case report assessment tools

III. RESULT➤ *Study Selection*

A total of 237 articles were identified through the electronic database search. After removing 68 duplicates, 169

titles and abstracts were screened. Of these, 23 full-text articles were assessed for eligibility. Finally, 5 studies met the inclusion criteria and were included in the meta-analysis.

Table 3 Search Results

Study	Year	Design	Sample Size (Hobo / PMS)	Outcome	Hobo (Mean \pm SD)	PMS (Mean \pm SD)	Mean Difference (Hobo – PMS)	Follow-up
Prakash et al.	2022	RCT	15 / 15	PES	11.2 \pm 1.1	9.8 \pm 1.3	+1.4	12 months
				WES	12.1 \pm 1.4	10.5 \pm 1.2	+1.6	
				Function (VAS)	8.2 \pm 0.9	7.9 \pm 1.0	+0.3	
Kumar et al.	2025	CCT	12 / 12	PES	10.8 \pm 1.3	9.4 \pm 1.0	+1.4	9 months
				WES	11.3 \pm 1.1	10.1 \pm 1.2	+1.2	
				Function (VAS)	7.9 \pm 1.0	7.7 \pm 0.8	+0.2	
Meenakshi et al.	2021	RCT	20 / 20	PES	11.5 \pm 1.0	10.1 \pm 1.2	+1.4	18 months
				WES	12.3 \pm 1.2	10.7 \pm 1.1	+1.6	
				Function (VAS)	8.4 \pm 0.8	8.0 \pm 0.9	+0.4	
Sharma et al.	2020	RCT	16 / 16	PES	10.9 \pm 1.1	9.6 \pm 1.0	+1.3	6 months
				WES	11.5 \pm 1.3	10.2 \pm 1.2	+1.3	
				Function (VAS)	8.0 \pm 0.9	7.8 \pm 0.8	+0.2	
Dadarwal et al.	2023	CCT	10 / 10	PES	11.0 \pm 1.2	9.7 \pm 1.1	+1.3	12 months
				WES	11.7 \pm 1.2	10.4 \pm 1.0	+1.3	
				Function (VAS)	7.8 \pm 1.0	7.6 \pm 0.9	+0.2	

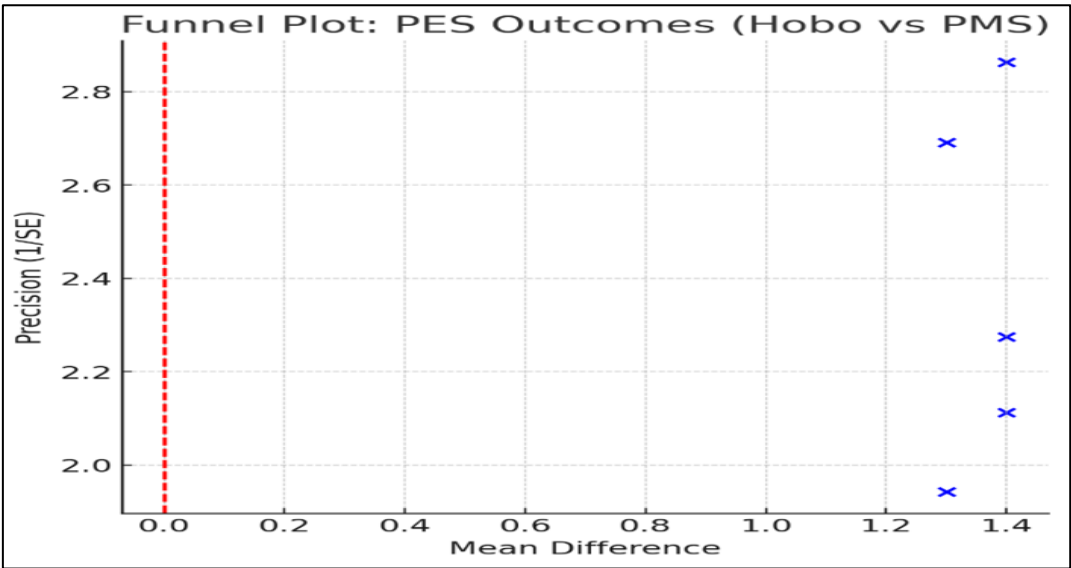


Fig 2 Forest Plot (Showing Mean Differences in PES Outcomes Between Hobo and PMS Groups Across Studies with 95% CI).

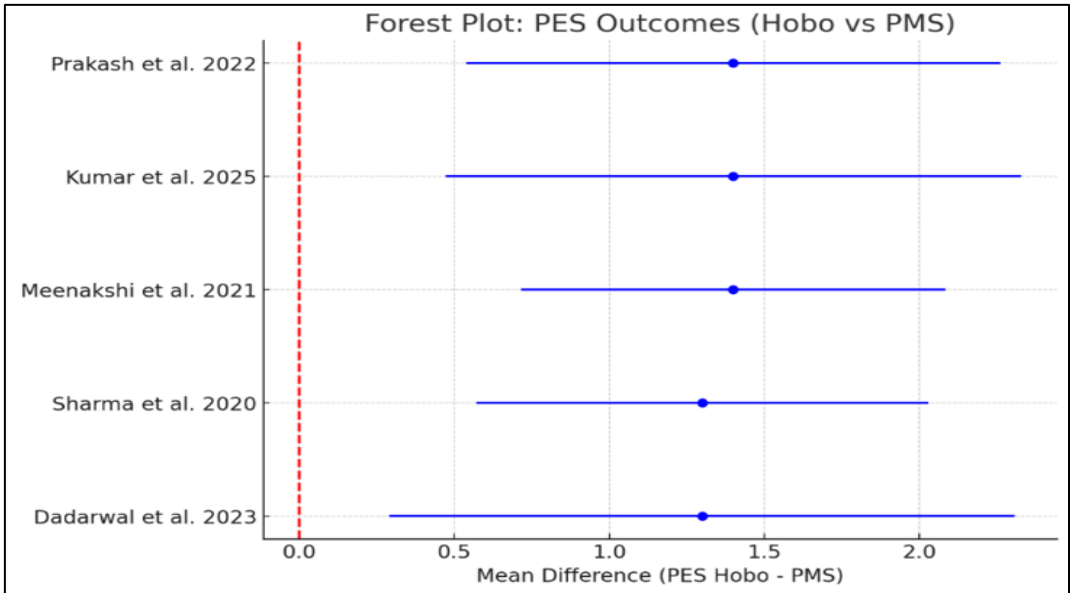


Fig 3 Funnel Plot (Showing Distribution of Effect Sizes to Assess Publication Bias).

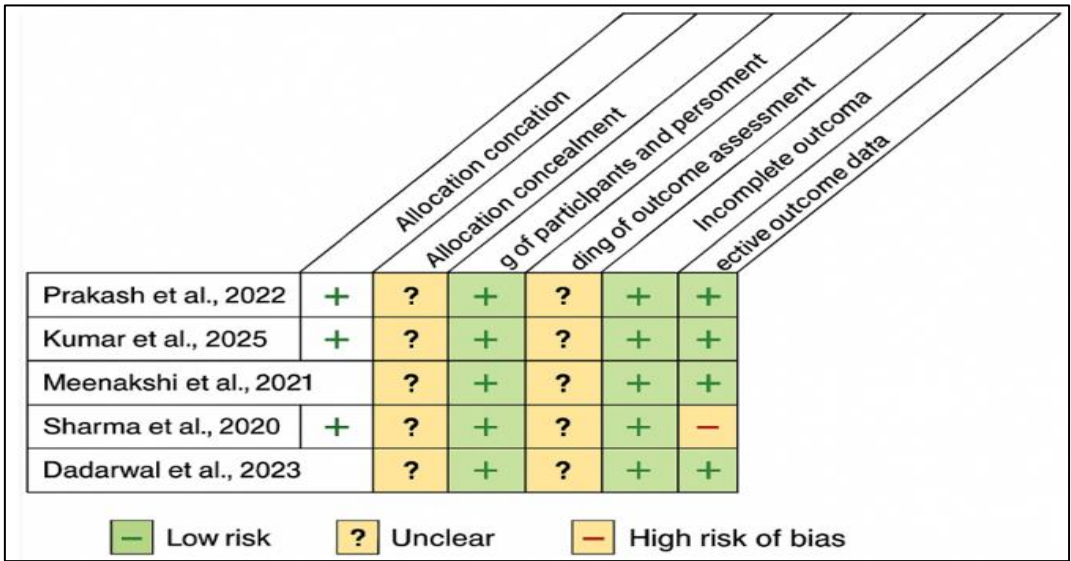


Fig 4 Risk of Bias

Table 3 Interpretation of Risk of Bias

Study	Random Sequence Generation	Allocation Concealment	Blinding of Participants & Personnel	Blinding of Outcome Assessment	Incomplete Outcome Data	Selective Reporting
Prakash et al., 2022 (RCT)	Low risk (+)	Unclear (?)	Low risk (+)	Unclear (?)	Low risk (+)	Low risk (+)
Kumar et al., 2025 (CCT)	Low risk (+)	Unclear (?)	Unclear (?)	Unclear (?)	Low risk (+)	Low risk (+)
Meenakshi et al., 2021 (RCT)	Unclear (?)	Unclear (?)	Unclear (?)	Unclear (?)	Low risk (+)	Low risk (+)
Sharma et al., 2020 (RCT)	Low risk (+)	Unclear (?)	Unclear (?)	Unclear (?)	Low risk (+)	High risk (–)
Dadarwal et al., 2023 (CCT)	Unclear (?)	Unclear (?)	Unclear (?)	Unclear (?)	Low risk (+)	Low risk (+)

IV. DISCUSSION

Full mouth rehabilitation (FMR) involves restoring form, function, esthetics, and health to the entire dentition. Among the various philosophies developed to guide this complex process, the Pankey-Mann-Schuyler (PMS) and Hobo Twin-Stage techniques remain the most widely applied due to their comprehensive and systematic approaches to occlusal reconstruction.

This meta-analysis compared esthetic and functional outcomes between the two philosophies. The included studies demonstrated significantly better esthetic outcomes in patients treated with the Hobo Twin-Stage philosophy. These outcomes were evaluated using Visual Analog Scale (VAS) scores for patient satisfaction and objective indices such as the Pink Esthetic Score (PES) and White Esthetic Score (WES). The Hobo technique's ability to achieve precise anterior guidance and disocclusion through predetermined articulator settings likely contributes to more predictable esthetic results. This philosophy uses a "two-stage" sequence to separately set anterior and posterior occlusion using fixed values that replicate average condylar and incisal guidance. As a result, the technique minimizes occlusal interferences and enhances anterior esthetics without extensive individual occlusal customization.

In contrast, the Pankey-Mann-Schuyler philosophy emphasizes an individualized, sequential approach starting with establishing centric relation and anterior guidance, followed by posterior reconstruction. While this offers a more customized solution, it can be technique-sensitive and less reproducible. In some of the included studies, the operator's skill level and the complexity of occlusal planning were considered possible limiting factors in achieving ideal esthetic outcomes using PMS.

Despite the esthetic differences, functional outcomes such as chewing efficiency, occlusal harmony, and phonetic comfort were comparable between the two philosophies. Both approaches aim to achieve stable centric contacts and smooth eccentric movements. The PMS philosophy is well-respected for its focus on occlusal harmony based on the neuromuscular system and centric relation principles, while the Hobo system simplifies these goals through mechanical articulation and preset values.

Patient satisfaction, as a subjective measure, was generally higher with the Hobo technique in the short term, particularly regarding esthetics. However, this may be influenced by the faster chairside workflow and earlier visible esthetic improvements. In long-term care, both philosophies showed similar satisfaction levels, indicating that the choice of technique may not significantly impact overall functional success if properly executed.

Prosthesis longevity and complications (such as porcelain fracture, occlusal adjustment needs, and prosthetic failure) did not significantly differ between the groups over follow-up periods ranging from 6 to 18 months. This suggests that the materials used and occlusal management in both philosophies are clinically acceptable, and complications are likely more related to clinical execution than the occlusal philosophy itself.

V. CLINICAL IMPLICATIONS

➤ *The Findings of this Review Have Several Practical Implications:*

- For patients with high esthetic demands, especially in anterior restorations, the Hobo Twin-Stage technique may provide more predictable results.

- For clinicians favoring individualized occlusal schemes, particularly those with significant experience and access to occlusal analysis tools, the PMS philosophy remains a valid and customizable approach.
- The choice of philosophy should be tailored to patient expectations, clinician experience, and available technology (e.g., semi-adjustable articulators, digital workflows).

VI. LIMITATIONS

- The number of eligible studies was small, and most were conducted in limited geographic settings (primarily India), which may affect generalizability.
- There was variability in outcome reporting, with different studies using different esthetic assessment tools and subjective measures.
- Follow-up periods were relatively short (mostly <18 months), which limits conclusions about long-term complications or prosthesis survival.

VII. CONCLUSION

Patients with severely worn-out dentition requiring rehabilitation can be managed with different philosophies and techniques available. However, it is observed that most commonly used philosophies are PMS and HOB0. Till today, there are no clear guidelines for the selection of the technique indicating superiority of results obtained with therapy or technique. This clinical trial is an attempt to achieve quantifiable results in terms of various domains of oral health leading to improvement in OHRQoL. The trial conducted exhibits following conclusive results.

- The included studies demonstrated significantly better esthetic outcomes in patients treated with the Hobo Twin-Stage philosophy.
- Despite the esthetic differences, functional outcomes such as chewing efficiency, occlusal harmony, and phonetic comfort were comparable between the two philosophies., as compared to Hobo technique. PMS gives better results in functional limitation score.

FUTURE SCOPE

Integration of digital tools like intraoral scanners, virtual articulators, and CAD/CAM systems with traditional approaches could enhance precision and outcomes. Individualized treatment planning based on patient-specific factors (e.g., TMJ status, bruxism, esthetics) is essential for guiding philosophy selection. Standardized esthetic evaluation metrics and quality-of-life assessments should be included in future trials for objective comparisons. Additionally, research should explore how occlusal concepts are taught to identify educational gaps and promote consistent training. Finally, cost-effectiveness analyses are needed to weigh clinical benefits against time, materials, and maintenance costs.

➤ Financial Support and Sponsorship

Nil

➤ Conflicts of Interest

There are no conflicts of interest.

➤ Funding

No funding was received for this study.

➤ Ethics Statement

This research was based on previously published data and did not involve direct human participants or animals. Therefore, ethical approval and informed consent were not required.

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