



REVIEW ARTICLE

Effect of Occlusal Schemes on Long- Term Prosthetic Success in Full- Mouth Rehabilitation – A Systematic Review

Dr. Namrata Agrawal^{1*}, Dr. Punit RS Khurana², Dr. Anju Aggarwal³, Dr. Aditya Chaudhary³, Dr. Kartika N Kumar³, Dr. Aryen Kaushik⁴

¹PG, ITS Dental College and Research Centre, Greater Noida

²HOD and Professor, Department of Prosthodontics, ITS Dental College and Research Centre, Greater Noida

³Professor, Department of Prosthodontics, ITS Dental College and Research Centre, Greater Noida

⁴Reader, Department of Prosthodontics, ITS Dental College and Research Centre, Greater Noida

*Corresponding author: Dr. Namrata Agrawal, ITS Dental College and Research Centre, Knowledge Park III, Greater Noida, Uttar Pradesh, 201310, Email ID: namrata2022@its.edu.in



Abstract

Purpose: This systematic review aims to evaluate the influence of canine-guided occlusion and group function occlusion schemes on long-term prosthetic success in full-mouth rehabilitation for adult dentulous and partially edentulous patients.

Materials and Methods: Following PRIMA guidelines, systematic search of the literature was conducted in PubMed, Google Scholar, Cochrane, EBSCO, Web of Science, and Scopus databases using the terms “canine-guided occlusion,” “mutual protected occlusion,” “unilateral balanced occlusion,” “group function,” “full-mouth rehabilitation,” and “implant prosthesis.” The inclusion criteria comprised clinical trials, observational studies, and systematic reviews comparing the two occlusal schemes with outcomes including EMG activity, periodontal health, TMJ condition, occlusal wear, prosthetic failure, and patient satisfaction. Sixteen studies met the inclusion criteria.

Results: Canine-guided occlusion demonstrated a significant reduction in masticatory muscle activity, lower incidence of occlusal wear, and fewer ceramic fractures compared to group function occlusion. While no clear causation was established between occlusal schemes and temporomandibular disorders, group function occlusion showed a stronger association with TMD symptoms. For implant-supported prostheses, canine-guided occlusion showed better biomechanical behaviour and less bone resorption.

Conclusions: Canine-guided occlusion may offer several advantages over group function occlusion in full-mouth rehabilitation, particularly in reducing masticatory muscle activity, prosthetic complications, and occlusal wear. However, individual clinical scenarios must guide the selection of occlusal schemes.

Keywords

Full mouth rehabilitation, Canine guided occlusion, Group function occlusion, Mutually protected occlusion, Unilateral balanced occlusion.

Introduction

Full-mouth rehabilitation (FMR) is a comprehensive dental treatment aimed at restoring the aesthetics, function, and overall oral health of patients with severely compromised dentition or partially edentulous situation using fixed prosthesis supported by teeth and/or implants [1]. A key component of successful rehabilitation is achieving proper occlusion, which involves the static relationship between the upper and lower teeth or tooth analogues [2]. Proper occlusion ensures even force distribution across dental arches, promotes stability, prevents premature wear, and supports long-term treatment success [1].

Various classifications for patients requiring FMR have been proposed, with Turner and Missirlian's classification being the most widely accepted [3]. They categorize patients based on occlusal wear into three groups: excessive wear with or without loss of vertical dimension, and with varying space availability [4]. The choice of occlusal approach—whether reorganized or conformational - depends on the patient's clinical condition and aims to optimize functional and esthetic outcomes [3].

In restorative dentistry, three ideal occlusion categories are recognized during eccentric movements: mutually protected, group function, and balanced occlusion. For complete dentures, balanced occlusion is preferred, whereas for natural dentition, canine-guided and group function schemes are commonly employed. These schemes emphasize the importance of canine and posterior teeth in establishing stable, harmonious occlusion [5].

The canine-guided occlusion scheme, as described by D'Amico, promotes a vertical chewing pattern and minimizes lateral forces by utilizing the guidance of canine teeth during excursive movements. This approach reduces the risk of occlusal instability, temporomandibular joint disorders, and excessive tooth wear [6]. Conversely, the group function scheme involves multiple teeth sharing occlusal contacts during lateral movements, distributing forces more broadly and reducing localized stress [7].

Understanding the influence of these occlusal schemes is essential for clinicians to make informed treatment decisions, ensuring durable and functional outcomes. Factors affecting the success of FMR include occlusal scheme selection, occlusal stability, patient adaptation, and the integrity of prosthetic components. Proper assessment and classification of the patient's condition guide the choice of the most appropriate occlusal approach, ultimately contributing to the longevity and success of the rehabilitation process.

Methods

Protocol and registration

A Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 protocol for a systematic review was followed. This systematic review is registered under the International Prospective Register of Systematic Reviews (PROSPERO) bearing registration number- CRD420251007087

Focused Research Question

This systematic review was designed to address the clinical question:

“Is the use of a canine-guided occlusal scheme more successful than a group function occlusal scheme for full-mouth rehabilitation in adult dentulous or partially edentulous patients?”

Eligibility criteria

Population (P): Adult dentulous or partially edentulous patients undergoing full-mouth rehabilitation.

Intervention (I): Full-mouth rehabilitation with a canine-guided occlusion scheme.

Comparison (C): Group function occlusion scheme.

Outcomes (O): Prosthetic success, assessed by variables such as muscle activity (EMG), occlusal wear, prosthetic failure (ceramic fracture), temporomandibular joint disorders, bone resorption, and patient satisfaction.

Studies involving edentulous patients rehabilitated with complete dentures, case reports, editorials, letters, abstracts without full-text access, and non-English publications. Were excluded from the study

Study design

Clinical studies, including cross-sectional, cohort studies, randomized controlled trials, and systematic reviews, were considered. Only studies conducted on humans and published in English that evaluated occlusal schemes (canine-guided vs. group function) in full-mouth rehabilitation were included.

Search Strategy

A comprehensive literature search was conducted using PubMed, Google Scholar, Scopus, Cochrane Library, and EBSCOhost databases with search terms related to occlusal schemes and full-mouth rehabilitation. Grey literature and hand searches were also included.

The search string was

((group function [Text Word]) AND (canine guided occlusion [Text Word]))

((group function [Text Word]) AND (canine guided occlusion [Text Word])) AND (dentulous patients [Text Word])

((group function [Text Word]) OR (canine guided occlusion [Text Word])) AND (dentulous patients [Text Word])

(canine guided [Text Word]) OR (group function occlusion [Text Word]) AND (implant prosthesis [Text Word])

((canine guided) AND (group function)) AND (longevity) ((canine guided occlusion) OR (group function occlusion)) AND (patient satisfaction [Text Word])

canine guided [MeSH Terms]) AND (group function occlusion [MeSH Terms])

canine guided [MeSH Terms]) OR (group function occlusion[MeSH Terms])

((canine guided occlusion) OR (group function occlusion)) AND (occlusal wear)

[Text Word])

full mouth rehabilitation

"full"[All Fields] AND ("mouth rehabilitation"[MeSH Terms] OR ("mouth"[All Fields] AND "rehabilitation"[All Fields]) OR "mouth rehabilitation"[All Fields])

Study Selection and Data Extraction

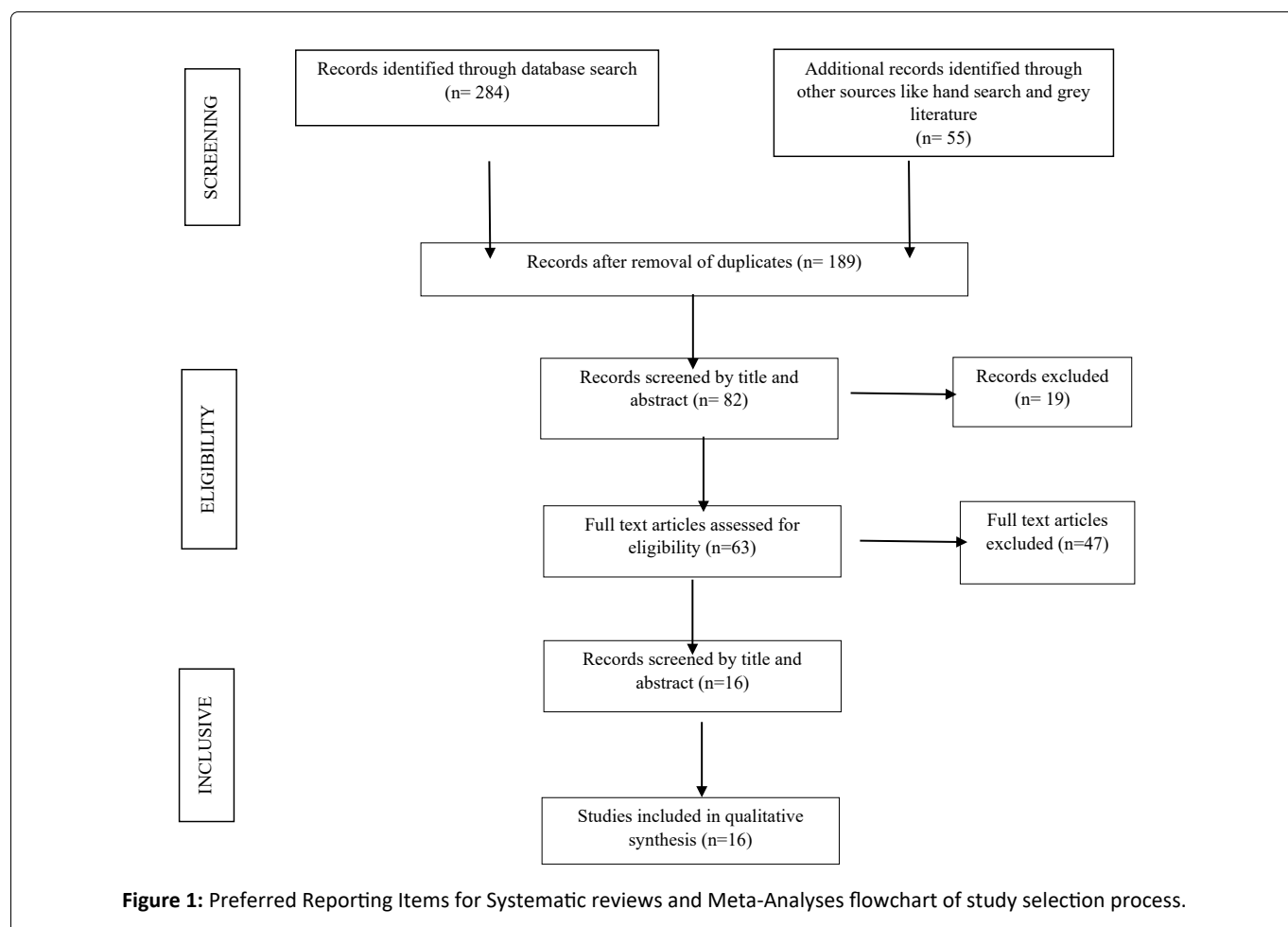
A systematic search adhering to PRISMA guidelines was performed in major databases. Studies published in English assessing canine-guided versus group function occlusion in adult patients undergoing full-mouth

rehabilitation were included. The PICO framework guided the search strategy. Data extraction included study design, population, intervention, outcomes, and conclusions.

A total of 339 studies were recovered from the electronic databases. After the removal of duplicates, 82 titles and abstracts were screened, and 16 studies were assessed for full-text reading. Evidence from four studies supports canine guidance for superior masticatory efficiency and muscle relaxation, while two studies reported reduced electromyographic activity and less muscle fatigue with canine guidance. One study indicated increased tooth mobility with canine guidance, whereas another showed better periodontal health. Three studies demonstrated that canine guidance provides better protection against tooth

Table 1: Description of included studies.

Author (Year)	Study Type	Population	Intervention/Comparison	Outcome	Conclusion
Leary (1972)	Cross-sectional	60 subjects (30/group)	Canine vs. group function occlusion	Higher mobility in canine-guided occlusion	Canine guidance may harm periodontal health.
Goldstein (1979)	Prospective	100 subjects	Various occlusions with resin tray	Lower tooth score in canine guidance	Canine guidance shows better periodontal health.
Manns (1987)	Prospective	6 subjects	Splints with increased VDO	Lower EMG in canine guidance	More muscle relaxation with canine guidance.
Johansson (1994)	Cross-sectional	80 subjects	Group vs. canine guidance	No wear correlation with occlusion type	Lateral schemes don't affect wear.
Akore (1995)	Cross-sectional	30 subjects	Canine vs. group function	Narrow chew cycle in canine guidance	Canine guidance preferred for less muscle activity.
Yi (1996)	Retrospective	34 subjects	FPD with different occlusion types	Similar satisfaction in all	Occlusion type didn't affect long-term results.
Kahn (1999)	Cross-sectional	345 subjects	Evaluate molar/lateral guidance	Higher canine guidance in symptomatic group	No occlusion pattern difference between groups.
Okano (2002)	Cross-sectional	20 subjects	Metallic overlays	Less EMG/load in canine guidance	Canine guidance advantageous for parafunction.
Okano (2007)	Cross-sectional	20 subjects	Simulated occlusions	More EMG in group function	Canine guidance causes less muscle fatigue.
Kinsel (2009)	Retrospective	152 subjects	Implants with 2 occlusion types	More ceramic fractures in group function	Group function has more complications.
Seifi (2012)	Prospective	32 subjects	FMR with implants/natural teeth	Less muscle contraction in canine guidance	Canine guidance better for reconstruction.
Haralur (2013)	Cross-sectional	100 subjects	TMD evaluation	Group function linked to TMD	Group function has higher TMD risk.
Abduo (2015)	Systematic review	26 studies	FMR	Mixed findings	Both occlusions acceptable; more studies needed.
Hashim (2015)	Cross-sectional	152 subjects	Occlusion vs. tooth wear	More wear in group function	Canine guidance protective against wear.
Gomes (2021)	Systematic review	5 studies	Various occlusions in implants	Better stress values in canine guidance	No best scheme defined; load distribution matters.
Ergunbas (2021)	Prospective	28 subjects	Implant FMR	Group function: more mesial bone loss	Occlusion not significantly linked to bone loss.



wear and restorative complications compared to group function. Two studies associated group function with a higher prevalence of temporomandibular disorders and symptoms. Conversely, two studies found no significant influence of occlusal scheme on long-term clinical success or wear. One systematic review reported that both occlusal schemes are clinically acceptable, though canine guidance may confer functional advantages, and another review emphasized that canine guidance allows for more favorable stress distribution without defining a single superior scheme.

Discussion

The primary goal of full-mouth rehabilitation is to restore the normal physiological function of the masticatory system, which is essential for maintaining oral health and overall well-being. This process involves carefully selecting occlusal schemes to ensure that forces exerted on teeth are favorable, thereby preventing pathological conditions such as tooth mobility, periodontal disease, and temporomandibular joint disorders. Proper occlusion is fundamental in achieving synchronous harmony among the components of the stomatognathic system, including teeth, masticatory muscles, and temporomandibular joints, making the choice of an appropriate occlusal scheme a critical step in prosthetic rehabilitation, especially in cases involving mutilated dentition.

The data reviewed encompasses decades of research investigating various occlusal schemes, notably canine-guided occlusion and group function occlusion, in both natural dentition and implant-supported prostheses. These studies aim to evaluate the impact of different occlusal schemes on key factors such as tooth mobility, periodontal health, electromyographic activity, occlusal wear, patient satisfaction, and the longevity of dental restorations, providing valuable insights for clinical decision-making.

Electromyographic Activity and Muscle Function

Electromyography (EMG) is a diagnostic tool used to assess muscle activity, with high EMG readings indicating increased muscle effort, which may lead to fatigue. Multiple studies have examined how lateral occlusal schemes influence masticatory muscle activity. For instance, Manns et al. (1987) [8] demonstrated that canine-guided occlusion reduces electromyographic activity in elevator muscles compared to group-function occlusion, supporting its use in full-coverage occlusal splints. Similarly, Akore and Araagaquogljji (1995) [9] found that canine-guided occlusion results in a narrower chewing cycle and decreased anterior temporal muscle activity during mastication. Further research by Okano (2007) [10] confirmed that canine-guided occlusion is associated with lower EMG activity in temporalis and masseter muscles, indicating reduced

muscular effort. Systematic reviews by Abduo (2015) [5] and Miralles (2016) [11] reinforce these findings, suggesting that canine guidance consistently results in decreased muscle activity, which may contribute to reduced muscle fatigue and discomfort in patients.

Occlusal Wear and Its Clinical Significance

Occlusal wear is a critical factor influencing the success of full-mouth rehabilitation. Studies indicate that canine-guided occlusion tends to cause less occlusal wear compared to group function. Johansson et al. (1994) [12] observed higher wear in anterior regions during lateral and protrusive movements, with variations in lateral excursive schemes not significantly affecting wear levels. Hashim et al. (2015) [13] reported that patients with bilateral group function exhibited more tooth wear than those with canine-guided occlusion, highlighting the protective role of canine guidance in minimizing occlusal trauma and preserving tooth structure over time.

Impact on Temporomandibular Joint Health

Research exploring the relationship between occlusal schemes and temporomandibular joint (TMJ) disorders presents mixed results. Haralur (2013) [14] found a higher prevalence of group function occlusion among patients with TMD symptoms, suggesting a possible association. Conversely, Kahn (1999) [15] and Abduo (2015) [5] concluded that there is no definitive causal relationship between occlusal scheme and TMD, emphasizing that TMD etiology is multifactorial. Studies by Okano et al. (2002, 2007) [16,17] demonstrated that canine-guided occlusion is associated with lower TMJ loading and reduced parafunctional activity, which may be beneficial in managing or preventing TMJ disorders.

Tooth Mobility and Periodontal Health

Periodontal health is influenced by occlusal forces. Leary et al. (1972) [18] reported higher tooth mobility in subjects with canine-guided occlusion, whereas Goldstein (1979) [19] found that canine-protected occlusion was associated with better periodontal indices. These findings suggest that appropriate occlusal schemes can help maintain periodontal stability by minimizing excessive forces that contribute to periodontal breakdown.

Porcelain Fracture and Mechanical Complications

The durability of porcelain restorations is affected by occlusal scheme. Kinsel (2009) [20] observed that crowns with canine-guided occlusion experienced significantly fewer porcelain fractures compared to those with group function. Similarly, systematic reviews by Abduo (2015) [5] support the notion that implant-supported prostheses with group function are more prone to mechanical failures such as ceramic chipping, underscoring the importance of occlusal scheme selection in prosthetic longevity.

Patient Satisfaction and Restoration Longevity

Long-term patient satisfaction and prosthesis durability are vital considerations. Yi et al. (1996) [21] found that both occlusal schemes could achieve satisfactory long-term function, although implant-supported prostheses with canine guidance demonstrated superior longevity. Gomes et al. (2021) [22] reported higher incidences of ceramic fractures in group function occlusion, further emphasizing the protective benefits of canine guidance in maintaining restoration integrity over time.

Implant Support and Occlusal Scheme Optimization

In implant-supported prostheses, stress distribution is crucial for success. Ergunbas et al. (2021) [23] showed that canine-guided occlusion results in lower stress concentrations and less bone resorption, particularly in the distal regions. Gomes (2021) [22] concluded that canine guidance offers better stress management, reducing the risk of mechanical failure and promoting prosthetic longevity, making it a preferred scheme in implant dentistry.

Overall, the collective evidence indicates that canine-guided occlusion provides biomechanical advantages, including reduced muscle activity, minimized occlusal wear, lower TMJ loading, and decreased mechanical failures. While the relationship between occlusal schemes and TMD remains inconclusive, adopting canine guidance appears to be a prudent approach for optimizing prosthetic success and preserving oral health in both natural dentition and implant-supported restorations [24].

Conclusions

The result of this systematic review indicates that the choice of occlusal scheme can have significant implications for various aspects of oral health, including tooth mobility, periodontal health, muscle activity, occlusal wear, and the longevity of dental restorations. The preference for canine-guided occlusion is evident in multiple studies, especially when considering factors such as reduced muscle activity, lower incidence of ceramic fractures, occlusal wear, and associations with better periodontal health. However, it is crucial to note that individual variations and case-specific factors should be considered in determining the most suitable occlusal scheme for a patient.

However, within the limitations of this systematic review this can be concluded –

1. The use of a canine-guided occlusal scheme results in reduced activity of the elevator masticatory muscles. This scheme also helps to protect against occlusal wear.
2. None of the occlusal schemes are correlated with the development of temporomandibular disorders.

3. Canine-guided occlusion has a positive effect on periodontal health compared to other occlusal schemes.
4. Canine-guided occlusion is more favorable in terms of longevity, patient satisfaction, and technical complications when compared to group function occlusion.
5. For implant-supported prosthesis, canine-guided occlusion has been found to have favorable outcomes than group function occlusion.

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Conflicts of interest

There are no conflicts of interest.

Role of equal authors

Reviewing of studies for the construction of systematic review.

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