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REVIEW ARTICLE

Rehabilitation Strategies and Occlusal Vertical Dimension Considerations in the Management of Worn Dentitions: Consensus Statement From SSRD, SEPES, and PROSEC Conference on Minimally Invasive Restorations

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ABSTRACT

Objective: The Joint SSRD, SEPES, and PROSEC Consensus Conference aimed to provide clinical statements and recommendations for the rehabilitation of worn dentition and to evaluate the necessity of an evaluation phase when increasing the occlusal vertical dimension (OVD) during full-mouth rehabilitation.

Materials and Methods: Two systematic reviews were conducted before the conference. The findings of the reviews were analyzed, discussed in working group 2, and debated in plenary sessions until a consensus was reached. Consensus statements were formulated based on available evidence and expert opinion.

Results: Both direct and indirect minimally invasive approaches, utilizing materials such as composite resins and lithium disilicate ceramics, were deemed viable for managing worn dentitions. The choice of approach and material should depend on the extent of tooth substance loss and the treatment goals. Evidence on the necessity of an evaluation phase was inconclusive. However, an evaluation phase can aid in managing patient expectations, refining treatment sequencing, and supporting less experienced clinicians. Emphasis was placed on non-invasive and minimally

invasive techniques, adequate diagnostics, and the potential benefits of fixed interim restorations when evaluating increased OVD.

Conclusions: The consensus statements provide a framework for managing worn dentitions and decisions regarding OVD increases, emphasizing minimally invasive approaches and individualized treatment planning. However, gaps in evidence remain, particularly regarding the long-term effectiveness of materials and the evaluation phase. Future research is required to address these uncertainties, focusing on long-term outcomes, material comparisons, and patient-reported outcomes.

1 | Introduction

The management of worn dentitions and the decision to increase the occlusal vertical dimension (OVD) in patients with a worn dentition are significant challenges in restorative dentistry. Addressing these issues requires evidence-based approaches to achieve a balance between clinical success, patient satisfaction, and long-term outcomes. Recognizing the importance of these considerations, Group 2 of the Joint SSRD, SEPES, and PROSEC Consensus Conference developed clinical statements and recommendations focused on the rehabilitation of worn dentition through minimally invasive direct and indirect restorative approaches. In addition, the Consensus Conference addressed the need for an evaluation phase when increasing the OVD during full-mouth rehabilitation, providing guidance on its clinical utility and limitations. These recommendations were supported by two systematic reviews, which were thoroughly analyzed and debated within Working Group 2 and subsequently in the plenary sessions until a consensus was reached.

The first systematic review, "Rehabilitation of the Worn Dentition With Direct and Indirect Minimally Invasive Concepts," evaluated the survival and clinical effectiveness of various restorative materials and techniques for treating worn dentitions. This review highlights the viability of both direct and indirect minimally invasive approaches, identifying composite resins and lithium disilicate as key materials. The consensus emphasizes tailored treatment choices based on tooth substance loss and clinical objectives while calling for further research on long-term outcomes and material effectiveness.

The second systematic review, "Importance of an Evaluation Phase When Increasing the Occlusal Vertical Dimension," explored whether an evaluation phase is essential during full-mouth rehabilitation involving OVD increases. The findings indicate a lack of robust evidence supporting the necessity of this phase for clinical success. However, the evaluation phase may assist in managing patient expectations and ensuring treatment confidence for clinicians, especially in complex cases. The consensus underscores the need for comprehensive diagnostics and advocates further studies to establish clear protocols for OVD management.

Together, these reviews and consensus statements provide a foundation for advancing restorative strategies while identifying gaps that future research must address to optimize patient care.

2 | Systematic Review Paper 1

2.1 | Manuscript Title

Rehabilitation of the Worn Dentition With Direct and Indirect Minimally Invasive Concepts—A Systematic Review and Meta-Analysis.

2.2 | Major Findings

2.2.1 | Major Finding 1

The materials and application techniques reported for minimally invasive rehabilitation of worn dentitions include:

2.2.1.1 | Direct Techniques.

- Composite resin: nanohybrid and microhybrid.

2.2.1.2 | Indirect Techniques.

- Manually processed
  - Composite resin: microhybrid.
  - Silicate ceramics: feldspathic ceramic, heat-pressed lithium disilicate.
- CAD/CAM-fabricated
  - Composite resin.
  - Polymer-infiltrated ceramic network material (PICN).

These techniques and material were reported in 2 RCTs, 7 prospective, and 5 retrospective studies and included 52% direct and 48% indirect restorations.

2.2.2 | Major Finding 2

Direct and indirect approaches using manually processed composite resin restorations revealed similar survival rates after 3 years of clinical use (OR, 1.79 [95% CI, 0.64–5.05]; $p = 0.270$). The main reasons for failure were fracture in the posterior region.

These findings are based on 2 randomized controlled trials (RCTs) involving 57 patients, with a total of 249 indirect and 217 direct manually processed composite resin restorations.

2.2.3 | Major Finding 3

Manually processed composite resin was the most studied material with survival rates ranging from, direct [72%–99%] and indirect [55%–100%], up to 6 years follow-up.

These findings are based on 2 RCTs, 4 prospective 3 retrospective with 3925 restorations in at least 143 patients.

2.2.4 | Major Finding 4

Heat-pressed lithium disilicate was the most documented material for indirect restorations, demonstrating a high survival rate [range 98%–100%] over follow-up periods ranging from 3 to 11 years. A minimal material thickness of 1 mm was applied to the occlusal surface.

These findings are based on 2 prospective studies (1476 restorations in 66 patients) and 2 retrospective studies (204 restorations, in at least 15 patients).

2.2.5 | Major Finding 5

Subtractive CAD/CAM composites demonstrated survival rates ranging from 90% to 100% over a follow-up period of 5.5–6 years.

These findings are based on 1 prospective and 2 retrospective studies (674 restorations, in at least 27 patients).

2.2.6 | Major Finding 6

Polymer-infiltrated ceramic network material demonstrated a 100% survival rate.

This finding is based on 1 prospective study (192 restorations in 7 patients).

2.2.7 | Major Finding 7

Feldspathic ceramic showed a survival rate ranging from 95% to 100%.

This finding is based on 2 retrospective studies (107 restorations in an unknown number of patients).

2.2.8 | Major Finding 8

Gold alloy showed a survival rate of 92%.

This finding is based on 1 retrospective study (158 restorations in 25 patients).

2.2.9 | Major Finding 9

Additively manufactured materials were not reported in any of the studies.

These findings are based on the systematic search of the literature.

2.3 | Major Answered Questions

2.3.1 | Major Answered Question 1

In the short to medium term (< 6 years), both direct and indirect restorations are viable options for restoring the worn dentition.

2.3.2 | Major Answered Question 2

Composite resin is the most studied material for direct restorations, whereas heat-pressed lithium disilicate being is the most studied material for indirect restorations in the treatment of worn dentitions.

2.3.3 | Major Answered Question 3

High fracture rates in the posterior region limit the long-term survival (≥ 6 years) of manually processed composite resins, whether used in direct or indirect restorations.

2.4 | Major Unanswered Questions

2.4.1 | Major Unanswered Question 1

For the long term (≥ 6 years), insufficient data exist to establish a clear preference between direct and indirect restorations for the treatment of worn dentitions.

2.4.2 | Major Unanswered Question 2

The superiority of any specific indirect material cannot be determined due to the lack of comparative studies.

2.4.3 | Major Unanswered Question 3

The impact of treatment procedures using different materials on biological, technical, and esthetic complication rates, as well as patient-reported outcome measures (PROMs), remains unresolved.

2.5 | Clinical Recommendations

2.5.1 | Clinical Recommendation 1

Both direct and indirect approaches can be recommended for restoring worn dentitions.

2.5.2 | Clinical Recommendation 2

The choice of treatment and materials should be guided by the extent of tooth substance loss and the specific goals of the treatment.

2.5.3 | Clinical Recommendation 3

Lithium disilicate is an appropriate material for the indirect approach to treat the worn dentition. A minimal occlusal thickness may need to be respected.

2.5.4 | Clinical Recommendation 4

Depending on the clinical situation, preventing additional tooth substance loss without restorative treatment may be the strategy of choice.

2.5.5 | Clinical Recommendation 5

When restorative treatment is indicated, non-invasive or minimally invasive approaches should be performed.

2.6 | Recommendations for Future Research

2.6.1 | Recommendation for Future Research 1

Future studies should systematically examine the effectiveness and long-term durability of direct and indirect treatment approaches for the worn dentition, prioritizing minimally invasive concepts, particularly through randomized controlled trials, including split mouth study design.

2.6.2 | Recommendation for Future Research 2

Future research should focus on:

- Comparing the different treatment approaches, that is, direct and indirect.
- Comparing different types of indirect materials.
- Comparing non-invasive, minimally invasive, full-coverage techniques.
- Assessing the influence of treatment approaches and materials on biological outcomes and tooth longevity.
- Investigating clinical and technical parameters for the direct and indirect materials (preparation technique, optimal material thickness, maintenance, and cost-effectiveness).
- PROMs to determine maintenance requirements, intention-to-pay, efficiency of treatment and esthetic benefits.

2.7 | Consensus Statement

Both direct and indirect techniques, including minimally invasive approaches using composite resins, lithium disilicate, and other materials, are viable options for restoring worn dentitions. The material and treatment choice should be guided by the degree of tooth substance loss and treatment goals. Further research is needed to compare long-term outcomes and the effectiveness of different materials and techniques.

3 | Systematic Review Paper 2

3.1 | Manuscript Title

Importance of an Evaluation Phase When Increasing the Occlusal Vertical Dimension: A Systematic Review.

3.2 | Major Findings

3.2.1 | Major Finding 1

The review revealed a lack of evidence supporting the necessity of an evaluation phase when increasing the Occlusal Vertical Dimension (OVD) for full-mouth rehabilitation.

These findings are based on data extracted from 104 articles (1 RCT and 103 non-comparative studies), of which 23 articles did not include an evaluation phase, whereas 81 articles implemented one.

3.2.2 | Major Finding 2

Dentate patients are adaptable to increases in OVD and can be successfully restored with or without an evaluation phase.

These findings are based on the data extracted out of the 104 articles (1 RCT, 103 non-comparative studies):

- 19 articles reported a mean increase in OVD of 3.7 ± 1.8 mm at the incisal pin.
- 37 studies documented a mean increase in OVD of 3.2 ± 1.3 mm between the incisors;
- 13 studies measured a mean increase in OVD of 2.6 ± 1.2 mm in the molar region. The only RCT reported an increase ranging from 2.2 to 2.3 mm.

3.2.3 | Major Finding 3

A variety of methods are available for conducting an evaluation phase.

These findings are based on the data extracted out of the 81 articles which included an evaluation phase.

3.2.4 | Major Finding 4

All studies included a diagnostic evaluation with direct, indirect or digital mock-ups before the treatment phase, independent of whether an evaluation phase was performed, or not.

These findings are based on data extracted from 104 articles (1 RCT and 103 non-comparative studies).

3.3 | Major Answered Questions

3.3.1 | Major Answered Question 1

The results of this systematic review did not provide evidence to support or refute the need for an evaluation phase to successfully increase OVD in terms of comfort, speech, function, esthetics, TMJ dysfunction and pain.

3.4 | Major Unanswered Questions

3.4.1 | Major Answered Question 1

Are there specific conditions/clinical scenarios (e.g., amount of OVD loss, parafunctions, disorders, clinician preferences, cost, treatment time, restorative material) that demand for or against an evaluation phase?

3.4.2 | Major Answered Question 2

Is there a relationship between the amount of OVD increase and the indication for or against an evaluation period?

3.5 | Clinical Recommendations

3.5.1 | Clinical Recommendation 1

A thorough diagnostic evaluation (i.e., diagnostic wax-up, mock-up try-ins, digital diagnostic evaluation) is essential for successful treatment if an increase in OVD is indicated.

3.5.2 | Clinical Recommendation 2

As clear evidence-based indications for or against an evaluation phase are lacking, the clinician's expertise determines the treatment sequence to ensure a successful final outcome.

3.5.3 | Clinical Recommendation 3

An evaluation phase may be beneficial for managing patient expectations, aiding in treatment sequencing, and supporting less experienced clinicians in developing confidence and verifying planned treatment outcomes.

3.5.4 | Clinical Recommendation 4

An evaluation phase can be carried out using either removable appliances or fixed interim restorations. However, removable occlusal splint appliances are ineffective for assessing esthetics and may adversely affect patient satisfaction.

3.6 | Recommendations for Future Research

3.6.1 | Recommendation for Future Research 1

The review highlights the need for high-quality studies focusing on:

- Comparing the outcomes with and without an evaluation phase across various patient-related conditions to provide clearer guidance on the necessity and methods of an evaluation phase.
- Developing a standardized protocol for reporting on OVD increases, including:
  - Patient-reported outcome measures (PROMs)
  - Function, speech, esthetics, comfort, pain, and TMD outcomes at pre-operative, intra-operative and post-operative time points.
  - Material for definitive restorations.
  - Amount of OVD increase and location of measurement (e.g., incisal pin, incisally, posterior).
  - Details about provisional restorations used during the evaluation phase (fixed or removable; materials).
  - Duration of the evaluation phase.

3.6.2 | Recommendation for Future Research 2

Clinical long-term studies are essential to assess the outcomes of OVD increases over extended periods.

3.6.3 | Recommendation for Future Research 3

Further research is needed to evaluate the effectiveness and patient comfort of different types of interim restorations (fixed vs. removable) used during the evaluation phase.

3.7 | Consensus Statement

The need for an evaluation phase when increasing OVD in dentate patients remains unanswered. It is up to the clinician to determine the clinical situations in which an evaluation phase is performed.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.