

PREVENTION OF SECONDARY DEFORMATIONS OF THE DENTITION

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Relevance: Secondary deformations (or secondary malocclusions) of the dentition are a significant global concern within dentistry and orthodontics. These deformations typically develop following an initial malocclusion or after certain dental or orthodontic treatments and can affect chewing efficiency, speech articulation, facial esthetics, and psychosocial well-being [1]. According to recent global oral health data from the World Health Organization (WHO), malocclusions are among the most prevalent oral health problems worldwide, affecting about 39% of children and adolescents, with many cases progressing to adulthood if not intercepted [2]. Secondary deformations pose an even greater challenge because they often emerge due to inadequate long-term maintenance, relapse, or incomplete correction of the original malocclusion [3]. Prevention of these secondary issues not only benefits individuals by improving oral function and esthetics but also reduces the overall economic burden on healthcare systems by minimizing the need for repeat or extensive corrective treatments [4]. Hence, developing effective strategies to prevent secondary dentition deformities is a priority in contemporary dental practice.

Keywords: secondary deformations, dentition, malocclusion, orthodontics, relapse prevention, oral health, global burden, early intervention, retention protocols, preventive dentistry.

Introduction

Dentition deformities, or malocclusions, can compromise the harmonious alignment of teeth within the dental arches. When an original misalignment is partially corrected, poorly retained, or allowed to relapse, **secondary deformations** may occur [1]. These secondary deformities often have multifactorial etiologies involving biological factors (growth patterns, oral habits, or periodontal changes) and behavioral components (non-compliance with retention protocols, recurrence of deleterious habits, insufficient oral hygiene) [5].

Modern orthodontics and preventive dentistry have made significant progress in detecting and managing malocclusions at early stages. Nevertheless, secondary deformations continue to be a challenge, especially in patients with complex skeletal problems, prolonged treatment periods, poor compliance, or craniofacial discrepancies. Once a secondary deformation sets in, managing it can be more complicated and time-consuming than addressing the initial malocclusion.

The objective of this article is to (1) review risk factors and underlying causes that lead to secondary deformities of the dentition, (2) highlight global strategies used to prevent these conditions, and (3) present current evidence-based measures that optimize long-term stability after orthodontic treatment or other dental interventions. By focusing on prevention, dental professionals can preserve the treatment results, spare patients from additional invasive procedures, and contribute to overall oral health and well-being at a global scale.

Materials and Methods

Study Design

A narrative review of the literature was performed to identify key strategies and interventions aimed at preventing secondary dentition deformities. The article synthesizes clinical findings from various regions to present a global perspective on the issue.

Data Sources and Search Strategy

We searched electronic databases, including PubMed, Scopus, and Google Scholar, using keywords such as “secondary dentition deformities,” “malocclusion relapse,” “orthodontic retention,” “preventive dentistry,” and “oral health maintenance.” Articles published between 2015 and 2025 were prioritized to ensure a focus on current research and global guidelines. Some classical references prior to 2015 were included if they provided fundamental insights into secondary malocclusions and retention methods.

Inclusion and Exclusion Criteria

- **Inclusion:**
 1. Studies focusing on relapse or secondary deformations post-orthodontic treatment.
 2. Articles examining prevention protocols (retainers, reinforcement techniques, patient compliance).
 3. Global guidelines, systematic reviews, randomized controlled trials, and consensus statements.
- **Exclusion:**
 1. Studies unrelated to prevention of secondary dental or orthodontic deformities.
 2. Case reports without clear protocols for prevention.
 3. Articles not in English or lacking full text.

Data Extraction and Synthesis

Relevant information was extracted regarding the prevalence, etiology, preventive approaches, and outcomes of recommended interventions. Where possible, data were stratified by region to account for global differences in access to orthodontic care, cultural practices, and socioeconomic influences on oral health maintenance. The findings were then grouped into core themes: etiology and risk factors, diagnostic protocols, retention strategies, lifestyle interventions, and professional guidelines.

Analysis and Results

1. Etiology and Risk Factors for Secondary Deformations

Multiple factors contribute to secondary deformities of the dentition:

- **Insufficient Retention:** After orthodontic treatment, if retainers are not properly used or if retention protocols are discontinued prematurely, teeth may drift back to their former positions [6].
- **Growth and Developmental Changes:** In growing patients, jaw growth might continue asymmetrically or unpredictably, influencing previously corrected malocclusion [7].
- **Periodontal and Occlusal Health:** Periodontal breakdown or occlusal trauma can lead to shifts in tooth alignment, causing secondary deformities over time [8].

- **Oral Habits:** Habits such as tongue thrusting, thumb/finger sucking, or bruxism can reintroduce deforming forces on the dental arches and adversely affect a previously corrected malocclusion [9].
- **Skeletal Discrepancies:** For patients with skeletal jaw disharmonies, incomplete correction or relapse in skeletal changes can manifest as secondary deformities [5].

2. Diagnostic and Early Intervention Protocols

A. Comprehensive Assessment

Early detection of potential relapse risk is vital. Modern diagnostics — including **3D imaging**, **digital intraoral scanning**, and **cephalometric growth predictions** — enable dentists and orthodontists to identify early signs of relapse or suboptimal tooth movement [10].

B. Risk Stratification

Clinicians increasingly use risk stratification tools, factoring in patient age, type of malocclusion, periodontal status, and genetic predispositions. High-risk patients benefit from more rigorous follow-ups, personalized retainers, and supportive therapies (e.g., physiologic orofacial exercises).

3. Retention Strategies

Ensuring long-term stability of orthodontic results is crucial.

- **Removable Retainers (Hawley or Clear Aligners):** Removable appliances are popular for their flexibility and esthetics. However, they rely heavily on patient compliance [6].
- **Fixed Retainers (Lingual Wire):** Bonded retainers on the lingual surfaces of the anterior teeth improve retention for cases prone to relapse (e.g., lower incisors). However, fixed retainers may increase plaque retention and require diligent oral hygiene [3].
- **Hybrid Retention Approaches:** Some protocols combine fixed and removable retainers, especially in complex cases (e.g., severe rotations or extraction-based treatments).

4. Behavioral and Lifestyle Interventions

Dentists and orthodontists increasingly recognize the role of patient behavior in maintaining treatment results:

- **Oral Hygiene Education:** Proper brushing and flossing help preserve periodontal health, reducing the risk of tooth migration caused by inflammation or bone loss [9].
- **Habit Cessation Programs:** If parafunctional habits like thumb sucking, tongue thrusting, or bruxism persist, they can reintroduce forces that shift teeth. Habit-breaking appliances, myofunctional therapy, or counseling may be required [11].
- **Regular Follow-up Appointments:** Scheduled follow-ups allow early detection of any incipient relapse and the opportunity for minor refinements before deformities become significant [12].

5. Clinical Outcomes and Efficacy of Preventive Measures

Table 1 provides a simplified summary of how different retention and preventive measures correlate with relapse incidence, based on data synthesis from recent studies:

Preventive Measure	Typical Relapse Incidence	References
Fixed Retainers (e.g., lingual wire)	~5–15% relapse in first 2 years	[3], [6]
Removable Retainers (full-time wear)	~10–20% relapse if compliance good	[6], [12]
Hybrid Retention (fixed + removable)	~5–10% relapse	[6], [7]
Habit Cessation + Retainer Use	Significantly reduces relapse	[9], [11]
No Retention (or poor compliance)	Up to 50% or higher relapse	[3], [6]

While specific percentages vary across studies, the overall trend is clear: rigorous retention protocols and habit elimination dramatically reduce secondary dental arch deformities. Consistent follow-up further enhances these outcomes.

Conclusion and Recommendations

Summary of Key Findings:

- Secondary deformations** of the dentition commonly arise from inadequate retention, persistent habits, skeletal or periodontal factors, and patient non-compliance.
- Retention protocols** — whether fixed, removable, or hybrid — are pivotal for maintaining long-term results, yet all require proper oral hygiene and patient dedication.
- Early detection** of relapse potential and risk stratification enable clinicians to tailor prevention measures, such as extended retention or adjunct therapies, especially for high-risk cases.
- Behavioral and lifestyle interventions**, including habit cessation and regular follow-up, are equally important to sustain the stability of teeth alignment.

Global Perspective:

- In high-income countries, advanced diagnostics (like 3D scanning) and long-term follow-up protocols are increasingly adopted, showing success in reducing secondary deformities.
- In low- and middle-income countries, access to orthodontic care may be limited, and retention protocols can be challenging due to cost and limited follow-up capacity [2]. Global collaboration and outreach are essential to ensure equitable preventive care.

Recommendations for Practice and Further Research:

- Enhance Patient Education and Compliance:** Develop comprehensive educational materials to inform patients about the importance of retention and potential risks of relapse.
- Adopt Individualized Retention Protocols:** Tailor retention methods according to malocclusion type, patient age, and relapse risk factors.
- Implement Technology-Assisted Monitoring:** Encourage the use of tele-dentistry apps or remote monitoring (where resources allow) to track retainer usage and detect early signs of relapse.

4. **Strengthen Preventive Strategies in Underserved Areas:** Advocate international collaborations (NGOs, professional associations) to improve access to basic orthodontic care, preventive protocols, and maintenance in communities with fewer resources.
5. **Focus on Longitudinal Studies:** Further research should include large-scale, long-term clinical trials to compare different retention strategies and examine the role of emerging interventions (e.g., myofunctional appliances, digital retainer designs, or 3D-printed solutions).

By prioritizing prevention — through robust retention strategies, early diagnosis, and consistent patient support — dental professionals can help avert secondary deformities, enhance oral health outcomes, and reduce costs in the long run.

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