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Review Article

Factors Related to Stability after Deep Bite Correction

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Abstract

Deep bite is one of the most common malocclusions which has a various degree of relapse after orthodontic correction. To minimize relapse, the factors related to stability of deep bite correction need to be considers. The purpose of reviewing these articles was to investigate the factors that affect stability after orthodontic treatment from current studies. This review will be beneficial for treatment planning to achieve the best stability after orthodontic treatment.

Keywords: Deep Bite, Relapse, Stability, Orthodontic Treatment

Introduction

Stability of deep bite correction is a problem in orthodontics. During treatment, overbite decreases due to the mechanics of many appliances but tended to relapse after follow-up. The degree of relapse varied from many various studies that focused on different treatment methods and samples. The range of the overbite relapse rate in many studies was 20-50%[1-11] and the systematic reviews of Huang et al[12] noted that there was 29% overbite relapse after deep bite correction. Due to its high tendency for relapse after orthodontic treatment, deep bite correction is one of the most challenging for orthodontists[13].

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To minimize relapse, the characteristics of patients and treatment modalities need to be considered. Various characteristics have been reported[4, 6, 14-17] including relapse in the Curve of Spee, relapse of the interincisal angle, relapse from neuromuscular function and facial type with corresponding muscular function and growth patterns. Therefore, if individual characters can be identified as having an increased risk of overbite relapse, treatment mechanics and retention strategies may need to be considered to achieve the most stable result. The purpose of this study was to investigate factors that related to stability after deep bite correction from recent published studies.

From many recent studies, the factors that are possibly related to stability of deep bite correction can be classified into the following categories:

- Patient characteristics
  - Age of patient
  - Growth patterns
  - Pre-treatment Occlusion
- Treatment characteristics
  - Mechanical techniques
    - Extraction versus non-extraction
    - Continuous versus sectional archwire
  - Treatment results
  - Retention

Patient characters

– Age of patient

Generally, adolescent patients had higher turnover rates of alveolar tissue. In accordance with orthodontic treatment, many studies suspected whether the stability of treatment outcome between adolescence and adults was different. Harris and Vaden[18] compared the stability in adult and adolescent orthodontic patients with matched malocclusion and found minor differences between both groups, finding that adolescent treatment was slightly more stable.

Many studies reported stability after treatment with different functional appliances in patients diagnosed having a skeletal and dental Class II relationship with a dental deep bite. They concluded that the success of long-term treatment outcomes of all sagittal and vertical dimensions can be obtained by a mixed dentition period[6, 10, 15].

There is a study of Herbst-Multibracket treatment in Class II division 1 adult patients. After complete treatment with a successful dental class I relationship with at least 24 months of retention, the amount of occlusal relapse was less than or equal to 1.0 mm, which is no different from overbite relapse in other studies of Herbst treatments in mixed dentition. However, the amount of dental changes was mainly resulted in adult patients[7].

Moreover, Bock and Ruf[15] compared Herbst multibracket treatment stability with a retention period of more than 1 year between early adolescence, late adolescence and adults. The treatment produced significant molar relationship improvement in all groups, but the amount of skeletal effect was greater in late adolescence. Overbite correction in early adolescence, late adolescence and adults were 3.3 mm, 4.5 mm, and 4.3 mm, respectively. During retention, overbite relapsed significantly in late adolescence and adults being 1.0 mm (22%) and 1.1 mm (25.6%), respectively. In conclusion, overbite stability was slightly better for adolescents than for adults.

– Growth pattern

Bock et al[5] using Herbst treatment stated that occlusal stability after treatment offered stable correction of the sagittal occlusal relationships but the vertical relapse was more pronounced in prognathic (hypodivergent) cases.

Bock et al agreed with Danz et al[3], who analyzed the factors affecting stability and relapse of deep bite cases after orthodontic treatment and found that high angle facial types (hyperdivergent) had lower tendency of relapse. Additionally, they suggested that patients with a high angle who have backward rotation of the mandible indicate a spontaneous bite opening during growth.

The same result was found from Rozzi et al[2] who studied 60 patients with a mean age of 19.8 ± 1.4 years and who had Curve of Spee (COS) leveling by continuous archwire suggested that patients with vertical growth (hyperdivergent) patterns exhibited a greater stability of COS obtained by stable extrusion of posterior teeth had less deep bite relapse after 2 years follow up. In contrast, the patient with a horizontal growth pattern had more instability of relapse of flared lower incisors.

– Pre-treatment Occlusion

With respect to pre-treatment occlusion, initial deep overbite was found as important for post-retention overbite prediction. Kim et al[17] evaluated the predictor of long-term stability after deep bite correction in 62 Class II division 2 patients and stated that patients with deeper initial overbite tended to have more deep bite relapse, especially in the case of maxillary and mandibular incisors which were very upright pretreatment because they had a tendency to return to the original relationship. From stepwise multiple regression, initial overbite was selected as the most important predictor of post-retention overbite.

Moreover, it has been reported that COS tended to relapse more in subjects with the deeper COS pretreatment[3, 19]. COS is defined as the curvature of the mandibular occlusal plane. An exaggerated COS is frequently observed in dental malocclusions with deep overbites leading to improper functional occlusion. So the orthodontic goal is to minimize or flatten the COS[20]. Bernstein et al[3] studied patients with a mean age of 12.6 years who had class II division 1 deep-bite malocclusions and who were treated without extraction and COS leveling with continuous archwire to investigate the characteristics of relapse after long-term retention. They found that the COS tended to relapse more in subjects with the deeper COS. Even so, they stated that only 5 from 31 patients had residual COS over 1 mm, and none was deeper than 2 mm. Nevertheless, Shannon and Nanda[19] studied the correlation between the factors and stability of COS after orthodontic treatment in Class I and Class II patients with mean age of 14.5 years, both extraction and non-extraction plans were included. No relationship was revealed between skeletal measurements or pretreatment dental conditions to COS relapse, but post-retention overbite and irregularity index were positively correlated with COS of pre-treatment. These imply that relapse of COS is associated with changes in the incisor irregularity after treatment and the amount of COS correction.

Treatment characters

– Mechanical techniques

- Extraction versus non-extraction

A narrower dental arch was found in three dimensions after orthodontic treatment with tooth extraction. Space-closing mechanics in extraction orthodontic treatment tend to deepen the bite and it is difficult to correct or maintain the normal overbite relationship[21].

Danz et al[1] divided the sample into a relapse and a non-relapse group and identified risk factors predicting relapse after orthodontic treatment of deep bite. Four of 43 cases (10.3%) showed relapse of the incisor overlap (> 50.0% of incisor overlap). The relapse group consisted of three cases with extractions or missing teeth, and one case with all teeth present.

Stellzig et al[22] compared the factors class II division 2 patients treated by 4 premolar extractions and maxillary second molar extraction and found that the interincisal angle after maxillary second molar extraction reduced by 12.6 but only 3.9 degree after premolar extraction. Thus, the interincisal angle also increased in the 4 premolar extraction group at the end of treatment. These patients are at risk of relapse due to the increased interincisal angle; however, there is not a long-term observation period.

However, Shannon and Nanda[19] studied changes in the COS post orthodontic treatment and reported that extraction therapy is not associated with relapse of deep bite. Nevertheless, they stated that COS relapse was related to the degree of lower molar uprighting with treatment. Molar angulation uprighting during treatment showed less curve relapse.

- Continuous versus sectional archwire

Deep COS can be corrected by extrusion of lower premolars, intrusion of incisors, or a combination of these mechanics[11]. Designing the treatment objectives of deep bite correction is related to causative factors[23]. Continuous orthodontic archwire with reverse COS was performed to level the occlusal plane by extrusion of the premolars. A sectional arch wire was conceived to correct deep COS by intrusion of the incisors. A primary objective of these two techniques is to correct deep bite and to obtain stability of orthodontic treatment[11]. Each technique was judged by previous study results, and all these studies had favorable treatment results and stability[1, 8, 15, 24].

Figure 1: Deep bite correction with upper sectional archwire (loop mechanics) and lower continuous archwire.

Figure 2: Deep bite correction with lower sectional archwire technique (utility arch)

The most current study[11] compared long term effectiveness between sectional versus continuous archwire techniques in matched control patients and reported no significant differences in the results of long term overbite correction. With both techniques, the patient who had undergone incomplete leveling COS posttreatment had a higher occurrence of relapse than patients who had been completely levelled.

- Treatment results

Some studies reported incomplete antero-posterior and vertical correction could be a major cause of deep bite relapse[25, 26]. Lapatki et al[26] reported that incomplete correction or relapse of the anteroposterior dimension had a tendency to produce relapse of deep bite from overeruption of the incisors.

Danz et al[1] found 4 from 61 patients were defined in the relapse group of random malocclusion and treatment. Three subjects showed upper median diastema without interincisal contact. So it could be inferred that without an interincisal stop, a deep bite after the retention phase might occur. Moreover, relapse of deep bite increased significantly in the patients who had incomplete COS leveling. The result of comparison between the partial treatment and complete treatment group showed that patients with persistent deep bite after treatment have a high prevalence of impinging gingiva.

Additionally, Lapatki et al.[25, 26] reported that patients with a high position of lower lip after treatment presented relapse in deep overbite from excessive contact of the upper incisors and lower lip and so suggested that planning for intruding maxillary incisors can lessen deep bite relapse in patients with Class II, Division 2 malocclusion.

- Retention

Huang et al[12] reported that COS stability was obtained by fixed rather than removable retainers. The relapse occurred in the first few years after measuring overbite at 2 - 5 years posttreatment. Of that, 80% (mean 0.8 mm) of the total overbite relapse occurred in the first 2 years[27]. However, few studies reported the retention method and how long it was still in place.

Shannon and Nanda[19] determined factors associated with the stability of the COS after treatment and concluded that the COS relapse occurred less in fixed retainer patients than removable retainer patients at 2.8 years posttreatment.

Bernstein et al.[3] evaluated fixed retainers after non-extraction orthodontic treatment with COS leveling by using the continuous archwire technique. Fixed retainers of lower anterior teeth were used in all patients for an average of 3 years, 4 months. After the period of post retention (mean = 7 years, 5 months), the average COS relapsed was 0.50 mm, which is a very small clinical change.

Figure 3: Fixed retainer.

Figure 4: Removable retainer with upper anterior bite plane.

Danz et al[1] classified the treatment success after deep bite correction in randomly malocclusion and treatment. They found that 4 of 61 patients were defined in the relapse group. Three subjects showed upper median diastema and the other had

increased overjet due to dental class II relapse. All of them missed upper and lower fixed retainers. It could be explained that missing interincisal contact could develop deepening of the bite and when the fixed retainer was absent, relapse of the arch circumference might facilitate relapse of deep bite.

However, some studies[25, 26] stated the factors associated with deep bite treatment relapse. The average relapse was about 20% of the total correction of the anterior linguoversion and deep bite, and the retainer prescribed was associated with relapse 2 years posttreatment, but not with a longer posttreatment period. The major cause of relapse tendency was poor compliance of the patients.

Discussion and Conclusion

For the best result of orthodontic treatment for deep bite correction, besides knowledge of the causes of development of this malocclusion and proper treatment planning, the factors related to long term stability are very important for retaining an enduring treatment result. Although it is difficult to isolate the factors affecting overbite clearly, patient evaluation, appropriate mechanics, and a retention plan are also important for prevention of unwanted relapse.

Obviously, deep bite relapse in adult treatment is not much different from adolescents but is slightly higher because the tissue turnover rate is decreased, there is no skeletal change and there is decreased dentoalveolar adaptation[7, 15, 18].

With respect to growth patterns, most studies[2, 3, 5] which compared vertical growth patterns evidently concluded that patients with hyperdivergent growth patterns had a lower tendency of deep bite relapse after orthodontic treatment, especially in growing patients with backward rotation of the mandible who have spontaneous bite opening during growth and stable posterior teeth extrusion.

Almost Class II division 2 patients have dental deep bite and more deep bite relapse tendency because of the upright and supra-eruption of maxillary and mandibular incisors as a consequence of deep overbite with an increased interincisal angle at the beginning of treatment[17].

An initial deep bite and deep Curve of Spee are the characteristics that correlated with risk of a deep bite relapse from statistical analysis. However, they are not the only factors that relate to relapse because there is mild to moderate correlation and the relapse in the studies is less than 1 mm, which is not clinically significant[3, 17, 19].

Extraction treatment and space closing mechanics in deep bite patients is avoided initially because the dental arch tends to collapse and deepen the overbite. If extraction therapy is indicated as necessary, appropriate mechanics shall be implemented carefully against excess collapse of the arch. Some possible techniques include using large wires for maintaining the arch form[21].

Stable treatment outcomes can be achieved by the mechanics suitable for selected individual cases. Either sectional or continuous mechanics could be selected upon desired effect. Also post-treatment occlusion must achieve normal overjet and overbite, good posterior occlusion, a normal interincisal angle, and a normal soft tissue relationship[11, 15].

Fixed retainer application seems to be better for stability than a removable retainer because patient compliance is not required. So post-treatment occlusion would be still retained without exact compliance. Therefore, all deep bite patients with pre-treatment severely irregular incisors and over-erupted incisors with increased interincisal angles which have been treated with anterior intrusion or arch expansion, fixed retainer should be prescribed post-treatment for long-term retention[3, 25, 26].

For better stability of deep bite correction, the following are suggested:

- The retention period should be extended until growth has ceased.

- Good occlusion with normal overjet and overbite and a proper relationship of the teeth to surrounding tissue should be obtained before completing the treatment.

- long-term retention and overcorrection treatment can maintain treatment results.

- Where tooth extraction is planned in the case of a deep bite, one should be careful with the angulation of adjacent teeth as it could worsen the COS.

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