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Resolution of a 'Gummy Smile' Using the the DNA® Appliance

RESOLUTION OF A 'GUMMY SMILE' AND ANTERIOR OPEN BITE:

Using The DNA® Appliance

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Traditionally, orthodontists have used fixed appliances to apply forces to move teeth. The disadvantage of this approach is that inflammatory pathways are activated[1], which induce discomfort throughout the treatment. Furthermore, the tacit assumption is that when the teeth are leveled, aligned and rotated, the patient will be in a better state of oral health. However, there are other co-morbid conditions associated with malocclusions, such as temporo-mandibular joint (TMJ) dysfunction/headaches, snoring/obstructive sleep apnea (OSA) etc. that are often inadvertently overlooked or ignored. Therefore, it might be better to take a more holistic approach and provide a more thorough craniofacial correction rather than attempt to treat the teeth in isolation. Indeed, while many cases are initially treated successfully, orthodontists know that relapse can occur after treatment. The reasons for relapse are complex and remain incompletely understood.

Non-extraction protocols appeal to many clinicians practicing modern-day orthodontic correction as a way to reconcile dental and skeletal tissue relationships. In this regard, the DNA appliance system is designed to correct maxillo-mandibular underdevelopment in both children[2] and adults.[3-4] The acrylic-based DNA appliance (Fig. 1) typically has: 6 (patented) anterior 3-D axial springs™, a midline screw, posterior occlusal coverage, retentive clasps, and a labial bow. The DNA appliance is preferentially worn for approx. 12-16 hrs. during the afternoon, evening and at nighttime, but not during the day and not while eating, partly in line with the circadian rhythm of tooth eruption.[5] The aim of this study is to report the effects of oral myofunctional therapy (OMT), craniofacial development

with the DNA appliance, and case finishing with a fixed orthodontic appliance in an adult female who was previously orthodontically-treated as a teenager.

CASE HISTORY

A 39 year old woman presented to a dental office (All North Dental) requesting orthodontic treatment. The chief complaint was a 'gummy smile'. The medical history revealed no relevant conditions or medications. The patient indicated that she was a mouth-breather, and that she had her tonsils removed at age 4 yrs. In response to a sleep screening questionnaire, she responded that: it took her approx. 30 mins. to fall asleep; had a history of waking up gagging/choking and coughing, and that she did not wake up feeling refreshed. She indicated that she had been tested for OSA but the test result was negative. She also volunteered that she clenched her teeth during the day, and was inclined to grind her teeth at night. Her dental history revealed that she had orthodontic treatment from age 13-16yrs. and that she did not presently have a retainer. Extra-oral examination revealed evidence of facial asymmetry with unilateral narrow nares, a thin upper lip and anterior open bite. Vertical maxillary excess ('gummy smile') was noted on full smile (Fig. 2).

Intra-oral examination revealed an anterior open bite (AOB) with anterior tongue thrust on swallowing (Fig. 3). There was excessive wear of the cuspids and posterior teeth, and crowding of the upper and lower arches. Panoramic radiography revealed horizontal impaction of the lower third molars, with the upper third molars having been previously extracted. Tomographic radiographs of the TMJs showed some evidence of degeneration of the left condyle. A working diagnosis of Class I malocclusion with apertognathia complicated by protrusive bruxism was reached; with a differential diagnosis of upper airway resistance syndrome. After obtaining informed consent, it was agreed that the patient would be treated with OMT, a maxillary DNA appliance, and a mandibular DNA appliance or fixed orthodontics as needed, followed by appropriate retention.


Fig. 1

PROTOCOL

Alginate impressions were taken and the bite registration was recorded, using a phonetic bite registration.[6] An acrylic-based DNA appliance was fabricated (Space Maintainers Laboratory, Canada) and fitted. The patient was instructed to wear the appliance for 12-16 hrs. during the late afternoon, evening and at nighttime, but not during the day nor while eating. The patient was advised to use retainer-cleaner tablets but not a toothbrush to keep the appliance clean. Adjustments were made periodically every 4-6 weeks to keep the appliance in balance for the patient. Craniofacial development continued for 9 months in total, during which time the DNA appliance was replaced with fixed orthodontics to accomplish the


Fig. 2


Fig. 3


Fig. 4


Fig. 5

occlusion goals, which included anterior coupling. In this case, Speed brackets (Speed System Orthodontics, Cambridge, ON, Canada) were used in the following wire sequence: 0.014, 0.016, 0.018 with vertical elastics. The duration of fixed appliance therapy was 8 months in total.

The patient was also instructed in OMT to train the tongue, following a routine prescribed by a trained oral myofunctional therapist. This routine consisted of a series of exercises to retrain the tongue to rest in the roof of the mouth. It also encouraged a lips-together posture, and promoted breathing through the nose while at rest.

RESULTS

The patient reported that the DNA appliance was comfortable and there was no pain while wearing it. Arch development and bony remodeling of the palate necessitated periodic acrylic adjustments. After 7 weeks with one maxillary, acrylic-based DNA appliance, a significant improvement in lip posture/morphology and vertical maxillary excess was noted (Fig. 4). After 9 months of DNA appliance therapy and 8 months of fixed orthodontics, the patient was very pleased with the clinical results (Fig. 5), which included a wider smile, no 'gummy smile', anterior teeth able to couple for the first time (Fig. 6), and she reported no incidents of gagging, choking or coughing during sleep.

"This particular case was treated with a DNA appliance because diagnostic clinical facial features highlighted a need for midfacial development."

DISCUSSION

The human genome has been sequenced, and we now know that certain genes are involved in remodeling bone[1], tooth development[7] and tooth eruption.[8] Teeth are naturally-designed to move; for example, tooth eruption in a normally-growing child. In addition, the teeth in some people erupt in a specific arrangement, producing a beautiful smile. The unique arrangement of teeth is due to homeobox genes[9] that help produce an ideal bone morphology. In fact, a natural process called 'temporo-spatial patterning' is at work.[10] This process can be regarded as a blueprint or body plan that is encoded by genes. In fact, the axes of the entire body are under genetic regulation; a phenomenon called pattern formation[11] under the influence of an organizer region of the body plan, including the teeth. Commonly, however, the body plan undergoes environmental perturbations, producing malocclusions.[12] The DNA appliance system putatively uses a biomimetic approach to address these issues, invoking the concept of epigenetic orthodontics or gene-environmental interactions.

Anterior open bite can be divided into two etiologic categories: skeletal and dento-alveolar. Thus, therapeutic success relies on both structural and functional rehabilitation to guarantee stability of treatment.[13] Indeed, conventional treatment modalities for an AOB usually include orthodontic treatment combined with orthognathic surgery, but other restorative options for treatment can be successful.[14] However, alternative methods that harness physiologic processes might also be advantageous. For example, Chate and Falconer[15] used a simple orthodontic method to achieve re-intrusion of over-erupted teeth that were associated with AOB. More typically, a combined orthodontic-orthognathic protocol is used to correct AOB. However, Jensen and Ruf[16] evaluated the short-term success of combined orthodontic-surgical correction of AOB. They concluded that normal overjet and overbite with proper incisal contact is achieved in only 40% of subjects using that approach. Yet another approach in the correction of AOB is the use of temporary anchorage devices (TADs). For example, Waldman[17] used orthodontic TADs to provide a novel alternative to orthognathic surgery. The TADs provided skeletal anchorage for maxillary molar intrusion, allowing mandibular autorotation and subsequent open-bite closure. However, orthodontic mechanics were still needed at every stage in that case, unlike the case that we report here. Another difference in the protocol that we adopt here is the integration of an oral myofunctional therapist. Smithpeter and Covell[18] reported that OMT in conjunction with orthodontic treatment is highly effective in maintaining closure of AOB compared with orthodontic treatment alone. Therefore, we anticipate a stable result in this case; however, long-term review

will continue to ensure that relapse does not follow this initially-successful outcome. Indeed, the patient continues to wear the upper DNA appliance passively at night-time only; not as a retainer per se but as an 'anti-aging device' to prevent vertical drift of the face that occurs with age.

In summary, advances in technology and molecular science provide new approaches to orthodontic care in the 21st century for both adults and children. Molecular biology and molecular genetics have allowed human craniofacial growth and development to be studied and understood in ways that were not available previously. Thus, information on how natural developmental processes can be harnessed for clinical orthodontic correction is beginning to emerge. By understanding and appreciating developmental mechanisms and the sites and modes of tissue interactions, the natural processes of jaw growth and tooth movement can be mimicked for the benefit of the orthodontic patient. This particular case was treated with a DNA appliance because diagnostic clinical facial features highlighted a need for midfacial development. However, rather than conventional mechanics, the utilization of craniofacial growth and developmental processes was envisaged, using orthodontic wire for signal transduction.[19] Indeed, discernible changes were noted in the face, jaws and teeth. We believe these changes equate to an increased level of craniofacial homeostasis, in accord with the Spatial Matrix Hypothesis.[20-21] These early results abide by principles under the novel concept of biomimetic orthodontic correction, which takes craniofacial growth and epigenetics into account for orthodontic corrections associated with an enhanced level of craniofacial homeostasis.

Fig. 6

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