The repositioning Nance appliance: a fixed functional appliance and case report

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Abstract Functional appliances are primarily orthopaedic tools used to influence the facial skeleton in a growing child. These appliances may be fixed or removable. A fixed functional appliance referred to as the Repositioning Nance Appliance (RNA) was developed and a case report is presented.

The RNA is a fixed functional appliance consisting of bands on the upper first molars joined together with a 0.036-inch stainless steel wire that is bent around the anterior contour of the palate. Just lingual to the upper incisors the wire is complemented with an acrylic Nance button, which is modified with a downward and backward incline projection. The labial aspect of this projection is smooth and when the lower incisors come into contact with it, they are directed into an edge-to-edge relation with the upper incisors, brought about by forward positioning of the mandible. This has the net effect of relocating the mandible into a Class I relation. A 14-year-old boy in his late mixed dentition stage of dental development presented with mild crowding, a horizontal growth pattern and a skeletal Class II jaw relation caused by an underdevelopment of the mandible. Treatment was initiated using the RNA and continued for a period of 18 months. This was followed by full fixed appliances for another 12 months and resulted in Class I skeletal and dental relations, a reduced overjet and an improved facial profile. The RNA, if applied correctly is a simple fixed functional appliance that can be used with confidence, comfort and economy to both the patient and orthodontic practitioner.

Keywords Functional appliances · Mandibular retrusion · Phase I treatment

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Introduction

Functional appliances are primarily orthopaedic tools used to influence the facial skeleton in a growing child [1]. These appliances also exert some orthodontic effects on the dento-alveolar area. While conventional appliances use mechanical elements such as springs, elastics and ligatures to directly influence tooth position, functional appliances employ natural forces such as muscle activity, growth and tooth eruption to alter cranio-facial structures. By changing the muscle environment around the developing teeth, dento-facial orthopaedics alters the pattern of facial growth to promote harmonious facial balance [2].

The aim of functional therapy is to eliminate or minimise skeletal, dentoalveolar and muscular problems prior

to the cessation of growth. Timing of treatment is critical and functional therapy or growth modification must be complete before the growth spurt ends. Extended treatment time resulting in patient fatigue and poor compliance as well as additional costs must be considered where treatment is prolonged [3].

Tulloch [4] advises that one should consider the patient's age and maturity, severity of the initial condition, growth pattern and compliance before embarking on functional therapy. While most factors can be determined with precision, patient cooperation and compliance are unpredictable and these exert the greatest influence on the outcome of functional treatment. Although numerous appliances are available to overcome non-compliance, the Repositioning Nance Appliance (RNA)

(Figs. 1–4) can be a useful tool in the functional management of delinquent noncompliant class II patients where there is underdevelopment of the mandible.

Design and fabrication

The RNA was developed from the Nance holding arch [3], which consists of bands on the upper first molars joined together with a 0.036-inch stainless steel wire that is bent around the anterior contour of the palate where an acrylic button is incorporated to fit snugly on the palatal mucosa just lingual to the upper incisors. In the RNA the acrylic button is modified into a projection that extends from the gingival margins of the upper anterior teeth at a 45-degree incline towards the lingual aspect of the lower arch

Fig. 1 RNA-palatal view

Fig. 2 RNA-lateral view

Fig. 3 RNA-occlusal view

Fig. 4 RNA-Intraoral view

(Figs. 1–4). The labial surface of the acrylic projection is smooth and forms a slipway for the lower teeth to be guided into an edge-to-edge relation with the upper incisors upon jaw closure. This has the net effect of relocating the mandible into a class I relationship with the maxilla. The lingual aspect of the acrylic projection is hollowed out to provide space for the tongue and lend comfort to the patient.

The appliance is fabricated on working casts that have been articulated in an anterior edge-to-edge relation as recorded clinically using a protrusive wax bite.

Case report

A 14-year-old male Caucasian patient visited the Orthodontic Department of the Medunsa

Oral Health Centre at the University of Limpopo, complaining that his ‘teeth were skew and that the top teeth were biting in front of the bottom teeth’.

Extraoral examination (Fig. 5)

While the patient presented with good antero-posterior facial symmetry, his profile appearance showed a horizontal growth pattern with short anterior lower face height, a retrusive mandible, and a prominent prognion. Teeth visible on repose were 0/10 while on smiling the patient showed 9/10 of the maxillary incisors. The patient also had a convex profile with a class II lip relation.

Intraoral examination (Figs. 6 and 7)

The patient had an overjet of 9 mm and a 100% overbite whereby his upper incisors completely covered the lower incisors in centric occlusion. Tooth 55 was retained and there was no clinical sign of tooth 15. All third molars were unerupted while the 35, 37 and 47 were partially erupted. The first molars and canines were in a class II relationship and teeth 12 and 22 were flared labially while the 11 and 21 were lingually

inclined as is typical of a class II division 2 malocclusion. Crowding amounted to 2.5 mm in the maxillary arch and 1.5 mm in the mandibular arch.

Radiographic examination

The orthopantomogram (Fig. 8) confirmed the partially erupted 37, 35 and 47 as well as a retained 55. Tooth 15 was unerupted as well as all the third molars. From the hand-wrist radiograph (Fig. 9) it was evident that the epiphysis and the diaphysis of the middle phalange were of equal width and that the patient was at the prepubertal stage of growth [5]. Analysis of the lateral cephalogram (Fig. 10, Table I) confirmed that all values measuring horizontal jaw relations such as the ANB angle, the Wits value and convexity, point to a class II skeletal relationship, while measurements of vertical jaw relations such as the mandibular plane angle, the facial plane angle and the lower facial height confirm a brachyfacial growth pattern.

Treatment objectives

In managing this patient, the aims of treatment were to:

Fig. 5 Pretreatment extraoral views of the face

Fig. 6 A) Pretreatment intraoral right buccal B) Pretreatment intraoral frontal C) Pretreatment intraoral left buccal

Fig. 7 A) Pretreatment maxillary occlusal B) Pretreatment mandibular occlusal

Fig. 8 Pretreatment orthopantomogram

- Correct the skeletal and dental class II relationship to a skeletal and dental class I relation
- Improve the facial profile
- Remove the retained 55 and to erupt and align the 15
- Level and align the upper and lower dentitions
- Reduce the overbite and overjet to normal levels
- Monitor the eruption of the second and third molars in all quadrants
- Posttreatment retention

Treatment

Treatment involved initially extracting tooth 55 and converting the class II division 2 incisor relationship to a division I relation using a 2x4, 16"x16" stainless steel utility archwire with bands on the 16 and 26 and brackets on the 12–22. This appliance was used for eight weeks only and was followed by an RNA. After a year of wearing the RNA full fixed upper and lower appliances were placed (Fig. 11) and the RNA was removed six months later. Upon removal of the RNA, class II (two ounce) elastics were worn daily until deband. Total treatment time was 26 months with wire sequence progressing from 0.016" NiTi, 0.016" x 0.022" stainless steel and finally to 0.017" x 0.025" stainless steel wire. Retention consisted of a maxillary Hawley with an anterior bite plane and a mandibular spring retainer. All third molars were removed after deband.

Table I Pre and posttreatment cephalometric data

	Caucasoid normal	Pretreatment	Posttreatment
SNA	82°± 2	86°	85°
SNB	80°± 2	80°	81°
ANB	+2 ± 2°	6°	4°
WITS	0 to 1mm	+5 mm	+2 mm
CONVEXITY	2mm ± 2	+4 mm	+2 mm
FACIAL PLANE	87°	92°	92°
Y AXIS	59 ± 6°	62°	62°
SN-MAND. PLANE	32°	25°	25
SN-OCCL PLANE	15°	14°	14°
UFH: LFH	5:7	5:6	5:7
L1 to APO	+0.5 to 1mm	-5mm	-1mm
U1 to NA	22°	16°	18°
L1 to NB	25	17°	21°
NA to U1	+4mm	2 mm	2 mm
NB to L1	+4mm	3 mm	4 mm
U1 to L1	131°	145°	137°
L1 to Mandibular Plane	90°	92°	95°
Holdaway angle	7 to 15°	14°	14°
McNamara Mx:Md (diff) M	100:130 (30)	93:117	95:124
Facial Contour Angle (FCA)	-11.3°	-14°	-13°

Results

After a total of 26 months of active treatment, the following was achieved (Figs. 12–17, Table I):

- Conversion of the skeletal class II to a class I relationship
- Class I canine and molar relationships with functional occlusion from 7 to 7
- Reduction of the overjet and overbite

to within normal limits (i.e. 2mm each)

- Improved facial aesthetics in both the antero-posterior and vertical dimensions

Discussion

Conversion of the class II division 2 into a division 1 was essential to free the restriction

Fig. 9 Hand-wrist radiograph for staging of growth

Fig. 10 Pretreatment cephalometric analysis

Fig. 11 Repositioning Nance in position

of the upper incisors on the lower incisors so as to allow maximal advancement of the mandible with the RNA [7]. It also prevented the patient biting on the lower brackets and risking bracket breakages.

As with all growth modification procedures, use of the RNA usually commences at the peak of growth [8] and continues until skeletal growth is complete, as determined from the hand wrist radiographs [5]. In this patient the RNA was used for a total of 18 months. The appliance was well tolerated without any speech or eating difficulties and did not require renewal or re-adaptation, although this should be

considered every six to eight months depending on morphological growth changes and appliance deterioration. According to the growth prediction values given by Ricketts [6] the amount of mandibular growth achieved with the RNA is almost double that of normal growth (Fig. 16). Other posttreatment cephalometric values (Fig. 15, Table I) such as the ANB angle, the convexity and the lower facial height are all indicative of improved skeletal relations.

Mild dentoalveolar compensation did accompany the skeletal change as evidenced by a pretreatment lower incisor proclination from 17° to 21°. The

Fig. 12 Posttreatment extraoral views of the face

Fig. 13 A) Posttreatment intraoral right buccal B) Pretreatment intraoral frontal C) Pretreatment intraoral left buccal

Fig. 14 A) Pretreatment intraoral maxillary occlusal B) Pretreatment intraoral

labiomental fold remained unchanged, as did the prominence of the progenion. The patient was advised to seek the opinion of a maxillofacial surgeon for a genioplasty but declined, as he was happy with the orthodontic result. The third molars were surgically removed as these teeth showed no evidence of uprighting or erupting in spite of mandibular growth.

The RNA should be used with caution in dolichofacial types as overeruption of molars can occur and increase the vertical facial dimension. To avoid this unwanted

Fig. 15 Posttreatment cephalometric analysis

Fig. 16 Superimposition of cephalometric tracings on the cranial base showing pretreatment position in blacklines, predicted growth in grey lines [6] and posttreatment growth achieved with the RNA in dotted lines

Fig. 17 Posttreatment orthopantomogram

complication, a posterior bite plane can be incorporated that is in contact with the molars when the incisors are held in an edge-to-edge relation with the RNA. In this case however, the disclusion of the molars caused by the RNA was advantageous in erupting the molars, increasing vertical facial dimension from 5:6 to 5:7 (Fig. 15, Table I) and reducing the overbite (Figs. 6 and 13).

Due to the close proximity of the Nance button to the palatal tissues, it is important that oral hygiene be optimal and patients must be advised not bend the acrylic away from the palate in an attempt to clean it. Superfloss can be threaded under the appliance to control plaque accumulation.

A subtle benefit of the RNA is that it also serves as an anchor and space maintainer, and will prevent space loss if treatment planning should change to the extraction of upper first premolars and camouflage orthodontics [9] in cases of poor mandibular growth. Use of the RNA in this patient assisted in maintaining space for the eruption of the 15. The 15 erupted 8 months after the 55 was extracted and was subsequently bonded and guided into occlusion.

Conclusion

The RNA, when used in class II cases at the appropriate growth period, can be an effective fixed functional appliance particularly in patients where cooperation with other class II functional appliances have failed [10]. As the results of this case indicate, the RNA is easy to fabricate, comfortable and effective and can be added the operator's armamentarium of noncompliant functional orthopaedic appliances.

References

1. Moyers RE (1988) Handbook of Orthodontics. 4th ed. Chicago: Yearbook Publishers
2. Graber TM, Rakosi T, Petrovic AG (1977) Dentofacial Orthopedics with Functional Appliances. 2nd ed. St. Louis: Mosby
3. Mc Namara JA, Brudon WL (1992) Orthodontic and Orthopedic Treatment in the mixed dentition. Ann Arbor: Needham Press
4. Tulloch JFC, Proffit WR, Phillips C (1997) Influences on the outcome of early treatment for class II malocclusion. Am J Orthod Dentofacial Orthop 111(5): 533–542
5. Fishman LS (1987) Maturational patterns and predictions during adolescence. Angle Orthod 57(3): 178–193
6. Ricketts RM, Bench RW, Gugino CF, Hilgers JJ, Schulhof RJ (1979) Bioprogressive Therapy, (part 4)USA: Rocky Mountain Orthodontics
7. De Vincenzo, Winn JP, MW (1989) Orthopaedic and orthodontic effects resulting from the use of a functional appliance with different amounts of protrusive action. Am J Orthod 96: 181–190
8. Wieslander L (1974) The effect of force on craniofacial development. Am J Orthod 65(5): 531–538
9. Dawjee SM (2003) Camouflage orthodontic treatment for a skeletal class II patient – a case report. SADJ 58(4): 160–164
10. Nanda RS, Kierl MJ, Prediction of cooperation in orthodontic treatment. Am J Orthod Dentofacial Orthop 1992; 102(1): 15–21

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