Successful Treatment of Postpeak Stage Patients with Class II Division 1 Malocclusion Using Non-extraction and Multiloop Edgewise Archwire Therapy: A Report on 16 Cases

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Abstract

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Aim To determine cephalometrically the mechanism of the treatment effects of non-extraction and multiloop edgewise archwire (MEAW) technique on postpeak Class II Division 1 patients.

Methodology In this retrospective study, 16 postpeak Class II Division 1 patients successfully corrected using a non-extraction and MEAW technique were cephalometrically evaluated and compared with 16 matched control subjects treated using an extraction technique. Using CorelDRAW® software, standardized digital cephalograms pre- and post-active treatments were traced and a reference grid was set up. The superimpositions were based on the cranial base, the mandibular and the maxilla regions, and skeletal and dental changes were measured. Changes following treatment were evaluated using the paired-sample *t*-test. Student's *t*-test for unpaired samples was used to assess the differences in changes between the MEAW and the extraction control groups.

Results The correction of the molar relationships comprised 54% skeletal change (mainly the advancement of the mandible) and 46% dental change. Correction of the anterior teeth relationships comprised 30% skeletal change and 70% dental change.

Conclusion The MEAW technique can produce the desired vertical and sagittal movement of the tooth segment and then effectively stimulate mandibular advancement by utilizing the residual growth potential of the condyle.

Keywords cephalometry, Class II Division 1 malocclusion, mandibular advancement, multiloop edgewise archwire (MEAW), non-extraction, postpeak stage

Introduction

For Class II Division 1 patients who miss the peak stage, it is often hard to determine which treatment plan is most suitable. There is a plethora of choices—non-extraction correction through dentoskeletal adaptation, camouflage treatment through extraction of premolars, or orthognathic surgery for adults. Especially when it comes to a late adolescent or young adult who has a normally developed maxilla and a retrognathic mandible, the first of these options may have the least risks and lowest costs.

Publications about Class II Division 1 nonextraction correction through dentoskeletal adaptation in late adolescent and young adult patients are limited mainly to the use of removable and fixed functional appliances. A variety of treatment effects have been reported in the literature. McNamara described three young adult Class II patients trea-

ted with removable functional (Fränkel) appliances but presented no major improvements in skeletal or posterior dental relationships (McNamara, 1984). Bakke and Paulsen demonstrated Herbst treatment in an almost full-grown male of 17 years whose retrognathism of the mandible was overcorrected with marked dentoalveolar changes, an increase in mandibular length and ramus height, apposition and remodelling of condylar heads and flattening of the temporal joint surface (Bakke and Paulsen, 1989). Ruf and Pancherz studied adolescent and young adult patients treated with the fixed Herbst appliance using magnetic resonance imaging and the results suggested condylar and glenoid fossa remodeling (Ruf and Pancherz, 1998; 1999; 2004). Nalbantgil *et al.* found that the Jasper Jumper corrected Class Ⅱ discrepancies mostly through dentoalveolar changes in late-adolescent patients (Nalbantgil *et al.*, 2005).

The multiloop edgewise archwire (MEAW) technique, having been invented to correct the open bite (Kim, 1987), has turned out to be a desirable remedy for sagittal discrepancies (Kim and Han, 2001; Sato, 1994). Furthermore, clinical practice shows that the MEAW technique is equally effective when used with pre-adjusted appliances. In this retrospective study, 16 postpeak Class Ⅱ Division 1 patients who were successfully treated using a non-extraction and MEAW technique were selected. The purpose was to evaluate the effectiveness of this method for Class Ⅱ discrepancy correction, and to determine cephalometrically the mechanism of the treatment effects.

Materials and methods

Subjects

The MEAW and non-extraction group consisted of 16 postpeak Class Ⅱ Division 1 patients (9 females and 7 males), treated between 2003 and 2006 at the Department of Orthodontics, West China Hospital of Stomatology, Sichuan University, Chengdu, China. All were Chinese and their ages ranged from 13.5 to 23.2 years (mean ± SD, 15.6 ± 2.9 years). The patients were treated with either edgewise or pre-adjusted fixed appliances (0.022 × 0.028 inch slot) and MEAW technique (0.017 ×

0.025 inch). The active treatment periods ranged from 13 to 37 months (25.4 ± 8.3 months). The patient inclusion criteria were:

1) The developmental age before treatment was postpeak stage, as judged by the stages of cervical vertebral maturation (O'Reilly and Yanniello, 1988);

2) Subjects had suffered a Class Ⅱ Division 1 malocclusion caused by a normally developed maxilla and retrognathic mandible with at least an end-to-end (1/2 cusp) Class Ⅱ molar relationship bilateral;

3) The molar relationship and the anterior overjet were corrected or improved greatly, and the treatment effects were stable with no active force;

4) No tooth was extracted or missing except the 3rd molar;

5) The cephalometric landmarks necessary for the analysis were identifiable.

For all subjects, the temporomandibular joints (TMJ) were examined regularly during the treatment.

Sixteen postpeak Class Ⅱ Division 1 subjects with extraction of two maxillary first premolars or plus two mandibular premolars (first or second) for resolving the overjet, served as the control group. They comprised 11 females and 7 males (average age 15.9 years), who had been under treatment (28.1 ± 6.6 months) at the same hospital. MEAW was not used in the control group. Parameters of the control group which might have influenced the results were carefully matched to those of the study group, including age, duration of active treatment, crowding in dental arches, and the distribution of the pattern of facial growth (both groups containing only one vertical growth pattern subject).

Cephalometric analysis

Standardized digital cephalometric radiographs in habitual occlusion had been taken using Orthoceph OC100D cephalostat (General Electric Company, Instrumentarium Corp., Imaging Division, Finland). Cephalograms taken at the start of treatment (T1) and after treatment (T2) were analyzed. The digital cephalograms of each patient were traced with CorelDRAW® software (version 11.0; Corel Corp., Canada) in a short period by one
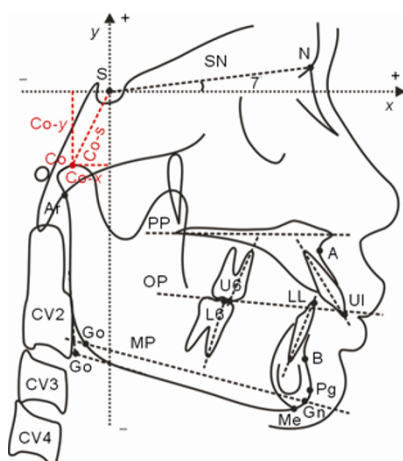
Figure 1 Measuring points and reference lines used in cephalometric analysis

Cephalometric reference points: S, sella; N, nasion; Co, condylion; Ar, articulare; A, point A; UI, upper central incisor; U6, upper first molar; LI, lower incisor; L6, lower first molar; B, point B; Me, menton; Gn, gnathion; Pg, pogonion; Go, gonion; Go', tangent gonion; CV, cervical vertebral.

Linear measurements include Ar, Go, Pg, B, A, tip of the mesial cusp of L6 (L6), incisal edge of lower incisor (LI), tip of the mesial cusp of U6 (U6) and incisal edge of upper incisor (UI).

Angular measurements included NSAr (saddle angle), SArGo' (articular angle), ArGo'Me (gonial angle), SUM (sum of NSAr, SArGo' and ArGo'Me), SN-FOP (functional occlusal plane), SN-PP (palatal plane), SN-GoGn (mandibular plane), L6 axis, LI axis, U6 axis and UI axis. When the teeth axes (L6, LI, U6 and UI) were measured, the values of pre-treatment (T1) were recorded as 0° and the values of post-active treatment (T2) recorded as positive if crowns tipped mesially or negative if crowns tipped distally.

examiner (J.L.). Correction was made for linear enlargement (100%). Tracing lines were set at 0.2 mm in width.

Cephalometric landmarks used for the analysis are listed in Figure 1. A reference grid was set up on pre-treatment (T1) cephalograms using Corel-DRAW® software (Figure 1). The reference lines were those used in previous investigations (Nalbantgil *et al.*, 2005). Briefly, the *x*-axis was a line constructed at 7° relative to the *S-N* line and the *y*-axis was a line down perpendicular to *x*-axis through the S point. Taking condylion (Co) as an example, Co-*x* means the distance from Co perpendicular to the *y*-axis; the value can be positive (on the left side of Sella (S)) or negative (on the right side of S). Co-*y* means the distance from Co perpendicular to the *x*-axis; the value can be positive (on the upside of S) or negative (on the downside of S). Co-S means the distance from Co to S; the value is always positive.

The method of superimposition for T1 and T2 cephalograms was based on the structural superimposition technique described and employed by some researcher (Björk, 1968; Björk and Skieller, 1983; Johnston, 1986). The superimpositions were completed and measured using CorelDRAW® software (Figure 2). Linear and angular measurements were made to the nearest 0.1 mm and 0.1°, respectively. The measuring points are listed in Figure 1.

Statistical methods

After an interval of 25 days, all cephalograms were traced, superimposed and re-measured.
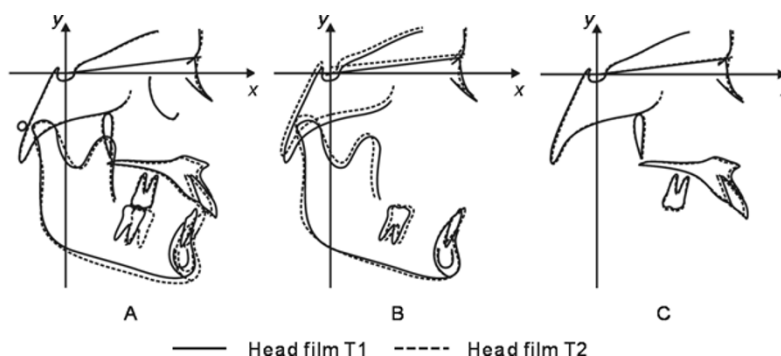

— Head film T1   ----- Head film T2

Figure 2 Superimpositional methods (Patient H.X.)

(A): Superimposition on cranial base; (B): Superimposition on mandible; (C): Superimposition on maxilla. T1, pre-treatment; T2, post-active treatment.

Dahlberg's formula was used to calculate the method error. Differences between the two sets of measurements were insignificant. The method error did not exceed 0.1 mm and 0.6° for the linear and angular measurements, respectively. For the final evaluation, the mean value of the duplicate registrations was used. The paired-sample *t*-test was used to evaluate the results of treatment for both the MEAW group and the control group. Student's *t*-test for unpaired samples was used to assess the differences in changes in each skeletal variable between the two groups during the treatment period.

Results

Dentoskeletal changes

Data for the MEAW group before and after the active treatment show that the correction of the malocclusion by non-extraction and MEAW was achieved both by skeletal and dental changes (Table 1). The correction of the molar relationships comprised about 54% skeletal change (mainly the advancement of the mandible) and 46% dental change (mesial movement of the lower molars), whereas about 30% of the correction of the anterior teeth relationships was attributed to skeletal change (advancement of the mandible) and 70% to dental change (protraction of the lower incisors and retraction of the upper incisors). Whole mandibular displacement and condylar growth and modification contributed to the forward and downward movement of the mandibular body (Table 1, superimpositions on cranial base and on mandible). The results suggest that modification might have occurred not only in the condyle but also probably in the glenoid fossa. There was no significant change in the SN-FOP (functional occlusal plane).

Condylar growth and modification were found in both the non-extraction and MEAW group and the control group, but the former group showed a greater change in the condyle (Table 2, superimpositions on mandible, Co-S) (*P*<0.05). Furthermore, compared with the control group, the downward movement of the whole mandible was significant (Table 2, superimpositions on cranial base) (*P*<0.05).

TMJ examination

No obvious signs or symptoms of temporomandibular disorder were found throughout the duration of the treatment. Some patients who had complained of TMJ click when opening or closing the mouth before the treatment showed that the symptom was relieved simultaneously with Class Ⅱ correction. Although long term elastics were applied carefully to help the TMJ remolding (for example, patient H.X. had worn the elastics for 24 months), the joints did not develop TMJ disorder. One reason was that the elastic forces were light and controlled.

Case presentation

H.X., a 16.5-year-old male, presented for correction of Class Ⅱ Division 1 malocclusion characterized by a nearly normally developed maxilla and retrognathic mandible (Figures 3A, 3B, 3C and 3J). A non-extraction treatment was planned with the possible need for extractions if the mandible could not be advanced. The upper and lower arches were banded and bonded through the second molars. The arches were firstly aligned and leveled with 0.014 inch NiTi and 0.016 × 0.022 inch NiTi. Then, 0.017 × 0.025 inch stainless wires (s.s.) with expansion and an exaggerated curve of Spee in the upper arch and a reverse curve in the lower arch were placed to level the arches. Light Class Ⅱ elastics were worn for leveling and mandibular advancement. After 4 months, a dual bite was present and the mandibular retracted when performing functions. Then MEAW (0.018 × 0.025 inch s.s., with tip-back bends and step bends for posterior extrusion) plus light short Class Ⅱ elastics (3/16 inch, 3.5 oz, 3M Uniteck, Monrovia, USA) were applied (Figure 4A). After 14 months, the mandible showed a steady advancement by 1/2 cusp. At the 35th month, the malocclusion was largely corrected and stabe, and active treatment was terminated (Figures 3D, 3E, 3F and 3K). Figures 2A, 2B and 2C show his cephalometric superpositions at T1 and T2. A pair of Hawley retainers was set in place for retention. Figures 3G, 3H, 3I and 3L show his stable occlusion 12 months after the completion of active treatment.

Table 1 Comparison of the cephalometric changes in the non-extraction and MEAW group (*n* = 16)

Variable	Pre-treatment		Post-treatment		*P*
	mean	SD	mean	SD	
Superimpositions on cranial base					
Co-*x* (mm)	−11.5	2.3	−10.5	2.3	*0.036**
Co-*y* (mm)	−20.3	1.9	−21.1	2.0	*0.085**
Co-S (mm)	23.6	2.3	23.6	2.5	0.962
Ar-*x* (mm)	−15.1	2.5	−14.3	2.4	0.055
Ar-*y* (mm)	−33.2	2.0	−33.7	2.3	0.065
Ar-S (mm)	36.5	2.7	36.7	2.9	0.438
NSAr (°)	126.6	4.3	125.5	3.9	0.064
SArGo' (°)	151.1	6.6	152.5	6.6	0.255
ArGo'Me (°)	114.0	6.1	114.0	6.2	0.993
SUM (°)	391.8	6.0	392.1	6.4	0.666
Go-*x* (mm)	−8.1	3.4	−7.4	4.0	0.218
Go-*y* (mm)	−76.5	5.4	−78.5	5.6	*0.000***
Go-S (mm)	77.4	5.7	78.9	5.8	*0.008***
Pg-*x* (mm)	60.2	5.1	61.3	6.2	0.053
Pg-*y* (mm)	92.9	9.7	95.4	9.6	*0.000***
Pg-S (mm)	112.0	8.5	115.3	7.9	*0.000***
SN- FOP (°)	19.3	4.7	18.5	5.2	0.444
SN-PP (°)	12.2	3.2	11.4	3.0	*0.038**
SN-GoGn (°)	30.8	5.7	30.4	6.6	0.358
L6-*x* (mm)	38.8	4.5	41.4	4.2	*0.000***
U6-*x* (mm)	38.9	4.2	39.5	4.2	*0.018**
B-*x* (mm)	59.2	4.7	60.8	5.3	*0.013**
B-*y* (mm)	−84.2	4.7	−86.0	4.7	*0.003***
B-S (mm)	103.0	5.0	105.6	4.8	*0.000***
A-*x* (mm)	65.1	3.6	65.9	3.7	*0.015**
A-*y* (mm)	−48.0	4.1	48.0	4.7	0.919
A-S (mm)	80.9	4.2	81.6	4.4	*0.012**
Superimpositions on mandible					
Co-*x* (mm)	−11.8	2.1	−12.3	2.0	0.200
Co-*y* (mm)	−20.6	2.1	−18.8	2.0	*0.004***
Co-S (mm)	23.6	2.5	22.1	2.1	*0.003***
Go-*x* (mm)	−7.9	3.2	−8.7	3.8	*0.011**
Go-*y* (mm)	−76.2	5.4	−76.3	5.4	0.831
Go-S (mm)	77.1	5.2	77.2	5.3	0.842
B-*x* (mm)	58.9	4.6	58.9	4.5	0.464
B-*y* (mm)	−82.1	4.8	−81.9	4.3	0.186
B-S (mm)	101.6	5.2	101.3	4.6	0.106
L6-*x* (mm)	38.9	4.4	40.1	4.2	*0.000***
L6-*y* (mm)	−62.4	4.0	−61.0	4.0	*0.000***
L6-S (mm)	74.4	4.2	74.0	4.2	0.089
L6 axis (°)	0.0	0	−4.2	2.8	*0.000***
LI-*x* (mm)	65.5	3.9	67.4	3.7	*0.000***
LI-*y* (mm)	−63.1	4.2	−63.8	4.0	*0.026**
LI-S (mm)	91.3	4.0	93.1	3.7	*0.000***
LI axis (°)	0.0	0.0	6.7	3.8	*0.000***

Table 1 cont.

Variable	Pre-treatment		Post-treatment		*P*
	mean	SD	mean	SD	
Superimpositions on maxilla					
A-*x* (mm)	64.9	3.7	64.9	3.7	0.917
A-*y* (mm)	46.5	4.1	46.5	4.0	0.984
A-S (mm)	79.6	4.3	79.5	4.2	0.559
U6-*x* (mm)	38.6	4.0	38.2	4.0	0.219
U6-*y* (mm)	−62.6	4.0	−63.1	3.9	*0.026**
U6-S (mm)	73.6	4.3	74.0	3.9	0.203
U6 axis (°)	0.0	0.0	2.2	2.9	*0.002***
UI-*x* (mm)	72.0	4.2	70.3	3.8	*0.000****
UI-*y* (mm)	−66.3	4.5	−67.4	4.6	*0.000****
UI-S (mm)	97.4	4.3	96.9	3.9	*0.024**
UI axis (°)	0.0	0.0	−4.7	6.1	*0.001***

*$P<0.05$, **$P<0.01$, ***$P<0.001$. Figures in italics and bold were statistically significant.
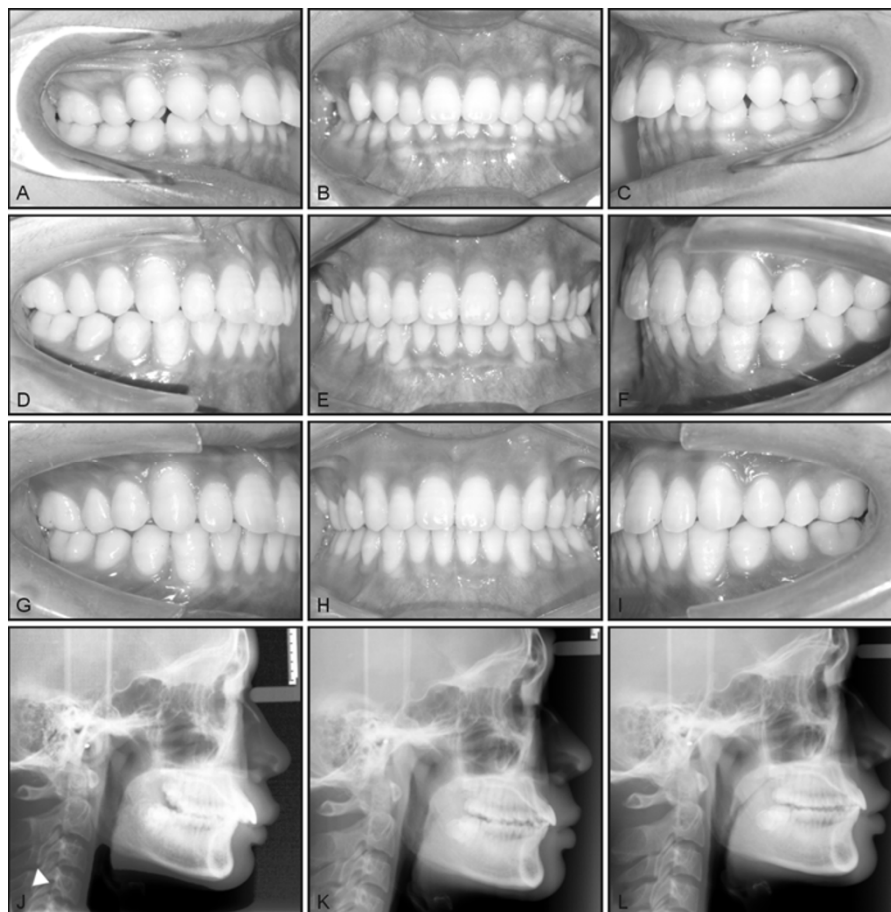

Figure 3   Case presentation of Patient H.X. whose malocclusion was successfully corrected by non-extraction and MEAW therapy

(A), (B) and (C): Intraoral photos before treatment showed nearly 3/4 cusp Class Ⅱ molar relationship; (D), (E) and (F): 35 months later, intraoral photos taken immediately after brackets were removed; (G), (H) and (I): 12 months later when the patient wore a Hawley retainer and made a return visit, intraoral photos show a stable occlusion; (J): Pre-treatment cephalogram, note the shape of the 4th cervical vertebra which indicated that the patient was in the postpeak stage; (K): Post-active treatment cephalogram; (L): Cephalogram taken 12 months after the completion of active treatment.

Table 2 Comparison of the skeletal changes between the non-extraction and MEAW group (*n* = 16) and the control group (*n* = 16)

Skeletal variable	Non-extraction and MEAW		Control		P
	Change	SD	Change	SD	
Superimpositions on cranial base					
Co-*x* (mm)	*1.0**	*1.8*	0.7	1.2	0.618
Co-*y* (mm)	*−0.8**	*1.3*	−0.3	0.5	0.368
Co-S (mm)	0.0	1.6	0.0	1.0	0.959
Ar-*x* (mm)	0.8	1.7	0.3	0.6	0.606
Ar-*y* (mm)	−0.5	0.9	−0.2	0.7	0.333
Ar-S (mm)	0.2	1.2	0.1	0.7	0.744
NSAr (°)	−1.1	2.2	−0.3	1.2	0.845
SArGo' (°)	1.4	4.6	1.6	3.2	*0.030**
ArGo'Me (°)	0.0	2.8	0.7	1.6	0.423
SUM (°)	0.3	2.6	1.6	3.4	0.293
Go-*x* (mm)	0.7	2.2	0.0	1.7	0.398
Go-*y* (mm)	*−2.0 ***	*1.7*	*−0.7**	*0.9*	*0.034**
Go-S (mm)	*1.5***	*1.9*	0.5	0.9	*0.016**
Pg-*x* (mm)	*1.9***	*2.4*	0.9	2.8	0.308
Pg-*y* (mm)	*−2.5****	*2.4*	*−1.1**	*1.4*	*0.046**
Pg-S (mm)	*3.3****	*2.1*	*1.8****	*1.1*	*0.015**
SN-PP (°)	*−0.8**	*1.5*	0.1	1.4	0.100
SN-GoGn (°)	−0.4	1.8	0.2	2.1	0.444
B-*x* (mm)	*1.6**	*2.3*	0.9	2.3	0.495
B-*y* (mm)	*−1.8***	*2.1*	−0.2	1.9	*0.025**
B-S (mm)	*2.7****	*1.8*	0.6	1.1	*0.004***
A-*x* (mm)	*0.7**	*1.1*	−0.1	1.0	0.066
A-*y* (mm)	0.0	1.4	−0.2	0.7	0.773
A-S (mm)	*0.7**	*1.0*	0.0	0.7	0.055
Superimpositions on mandible					
Co-*x* (mm)	−0.5	1.4	−0.8	1.1	0.360
Co-*y* (mm)	*1.8***	*2.1*	*1.2***	*1.2*	0.185
Co-S (mm)	*−1.5***	*1.7*	−0.5	1.1	*0.025**
Go-*x* (mm)	*−0.8**	*1.1*	*−0.9**	*1.8*	0.842
Go-*y* (mm)	−0.1	1.1	0.3	1.0	0.371
Go-S (mm)	0.1	1.1	0.1	0.9	0.957
B-*x* (mm)	0.0	0.6	−0.6	0.8	0.746
B-*y* (mm)	0.2	0.8	−0.1	0.6	0.618
B-S (mm)	−0.3	0.7	−0.5	0.8	0.340
Superimpositions on maxilla					
A-*x* (mm)	0.0	0.4	−0.5	0.7	0.169
A-*y* (mm)	0.0	0.7	0.0	1.0	0.984
A-S (mm)	−0.1	0.9	−0.2	0.9	0.495

*P<0.05, **P<0.01, ***P<0.001. Figures in italics and bold were statistically significant.

Discussion

Mechanism of MEAW effects

One of our most important findings was that the residual growth potential (Lewis and Roche, 1988; Behrents, 1985; Bjork, 1963) in postpeak stage patients, even in young adults, had been utilized by the MEAW technique during the correction of Class II malocclusion. Modified MEAW with tip-back bends and step bends for posterior extrusion plus short Class II elastics (Figure 4A) could produce the desired vertical and sagittal movement of the tooth segment. Temporary occlusal interferences might be present in posterior teeth, promoting mandibular advancement and TMJ modification. Construction of an ideal cusp-fossa relationship could then be induced by both skeletal and dental adjustments. The occurrence of the skeletal changes would contribute to longer treatment duration but greater improvement of the profile and more stability of the active treatment effects.

The dentoalveolar changes were equally important for the correction of Class II Division 1 discrepancy. The mesial movement of the lower molars accounted for nearly 50% of the success of correction of the molar relationships, under the function of short Class II elastics (Figure 4A). The incisors exhibited even more displacements during the correction of sagittal discrepancies than the molars, by protraction of the lower incisors and retraction of the upper incisors. The alignment and leveling of the arches and the moderate expansion of the upper arch (Voudouris and Kuftinec, 2000) eliminated possible occlusal interferences to the advancement of the mandible, which was a precondition for condylar displacement, growth and modification.

The extrusion of molars, caused by the combination of both step bends of MEAW and short Class II elastics therapy, increased the posterior dentoalveolar height. We hypothesize that it might act as a powerful pivot in the whole mandible "lever" (Figures 4B and 4C). The short Class II elastics might be another key stimulation, performing the function of a motive force in a Type I lever (Figures 4B and 4C). The traction force of the viscoelastic tissue (McNamara, 2000) loaded on the condyle (the resistance of the "lever") might then stimulate condyle growth modification effectively.
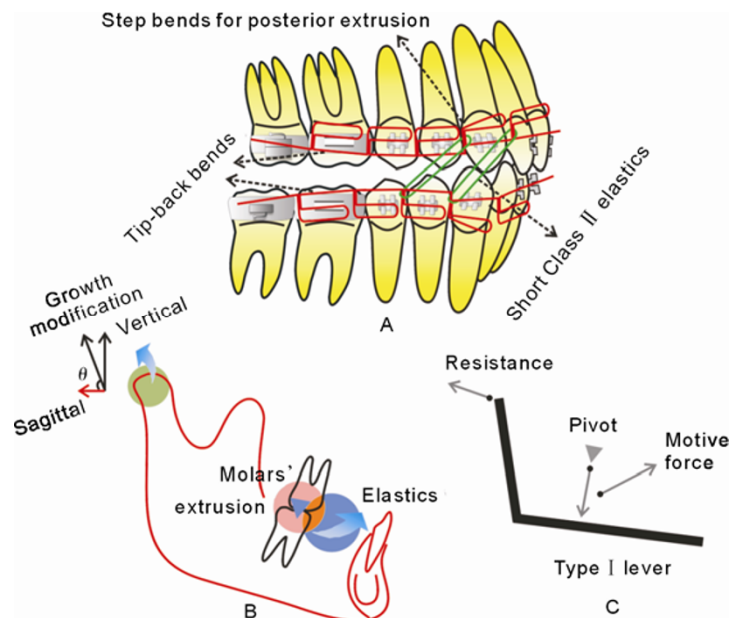

Figure 4   Analysis of MEAW mechanism

(A): MEAW with tip-back bends and step bends at the 2nd loops plus the use of short Class II elastics for posterior extrusion and distal tipping. (B): Schematic diagram of the biomechanical analysis of the MEAW effects on condylar modification. (C): Force diagram of the MEAW effects on condylar modification. Refer to text for detailed explanation.

Change of occlusal plane

It had been hypothesized that mandibular advancement is related to anticlockwise (upwards) rotation of the occlusal plane. Thus, we did not adopt Pancherz's superimposition method for quantitative evaluation of condylar growth modification (Shen and Darendeliler, 2006; Pancherz and Hägg, 1985), which used the original occlusal line as the reference line. However, our study did not show a significant change in SN-FOP.

Influence of pattern of facial growth

The 16 patients in the non-extraction and MEAW group contained 11 hypodivergent, 4 normodivergent and 1 hyperdivergent skeletal types. It has been suggested that the pattern of facial growth might have a connection with the curative effects. Björk pointed that the growth of the condyle was directed sagittally when the mandibular base was flat (Björk, 1963). Thus, when the residual growth potential of the condyle was guided and stimulated by the MEAW technique, the mandible of the hypodivergent type might have more sagittal advancement than that of the hyperdivergent type (as shown in Figure 4B, the hypodivergent type possibly having a smaller angle θ).

Weak masticatory muscles are associated with hyperdivergence whereas hypodivergence is usually linked with powerful masticatory muscles. The muscles of hypodivergent type might adapt the modification of condyle for the extrusion of molars whereas the muscles of hyperdivergent type might withstand the force loading. So it might be disadvantageous to extrude the molars in the postpeak hyperdivergence cases because the mandible could rotate clockwise to aggravate the hyperdivergence. For these cases, efforts for correction of the Class II relationship should be made in dental modification by extraction of the third molars and distal tipping of the upper molars by MEAW tip back bend (Figure 4A).

Indications

For some borderline skeletal Class II cases in postpeak stage, MEAW technique can be used as an alternative to orthognathic surgery. Although the 16 patients in this study showed a satisfactory correction of sagittal discrepancies without extraction of premolars, it is still difficult to anticipate the exact orthodontic effects for a new postpeak Class II Division 1 patient. Many factors can affect the result, such as the patient's compliance, the residual potential of growth (biological age), and possibly the duration and the magnitude of the elastics, the facial growth pattern and the functional status of the masticatory muscles. However, cases of severe skeletal Class II malocclusion should be treated with orthognathic surgery.

Conclusions

Sixteen postpeak Class II Division 1 patients successfully-corrected with non-extraction and MEAW technique were cephalometrically evaluated. The correction of the molar relationships comprised 54% skeletal change (mainly the advancement of the mandible) and 46% dental change; the correction of the anterior teeth relationships comprised 30% skeletal change and 70% dental change. MEAW technique together with short Class II elastics can produce the desired vertical and sagittal movement of the teeth or dentoalveolar segment and may stimulate mandibular advancement by utilizing the residual growth potential of the condyle.

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