Class II Mechanics for Noncompliant Patients

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Noncompliant patients have frustrated orthodontists since the inception of the specialty, and the problem only grows. It never diminishes. This has encouraged orthodontists to develop various and sundry appliances, both intraorally and extraorally, to overcome this reluctance in cooperation. Interestingly, the first of the apparatuses developed to enlist patients' total cooperation was the Saif spring, but no study was ever published in widely read orthodontic literature regarding its use or effect. Class II Saif springs and Class II elastics work in a similar manner, and the study presented here shows that some of the common misconceptions about the harmful effects of Class II forces do not necessarily apply. Most of the risks of Class II elastic forces can be controlled by careful planning and sound biomechanics. World J Orthod 2003;4:206–214.

Orthodontists must often work with noncompliant Class II patients, and this presents unusually difficult problems in the correction of sagittal discrepancies. Class II elastics have been the most traditional therapy, and these auxiliaries were first described by Case in 1893 at the Chicago Dental Society meeting.[1,2] Angle,[3] Jackson,[4] Dewey,[5] and others were also early advocates of elastics and frequently recommended them as Class II therapy.

Brodie, Goldstein, and Meyer published the first cephalometric study on Class II elastics, and they discovered several effects[6] that counteracted the beneficial horizontal correction that elastics offered. Soon others began to voice their doubts regarding the unalloyed benefits of Class II elastic therapy. Hopkins,[7] Fischer,[8] Bien,[9] and Freeman[10] wrote that the deleterious effects of elastics far outweighed their benefits, and that extraoral traction might be a better method of correcting Class II malocclusions. Schudy[11] was the first to write about the potential of Class II elastics to erupt the mandibular molars, rotate the mandible down and back, and, subsequently, make Class II correction more difficult.

Nevertheless, elastics have had strong advocates, such as Tweed,[12–14] Thurow,[15] Phelps,[16] and Root,[17] all of whom contended that the successful employment of Class II elastics was predicated upon judicious implementation. Of course, this involved at least a tooth sacrifice compromise in many instances.

Despite the condemnation and doubts about Class II elastics efficacy or efficiency, the clinical evidence for their usefulness is so strong and their use so ubiquitous that this study was designed to evaluate the most objectionable features of Class II elastic use. These features include *(1)* downward and backward movement of the mandible, due to molar extrusion; *(2)* forward displacement of the mandibular anterior teeth; *(3)* downward tipping of the occlusal plane; and *(4)* extrusion of the maxillary anterior teeth.

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Fig 1 *(Right)* Saif spring.

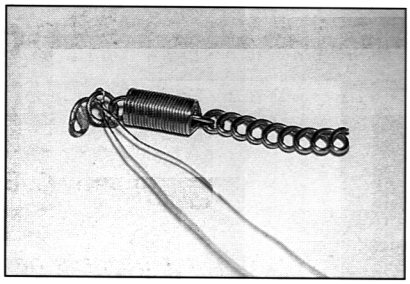
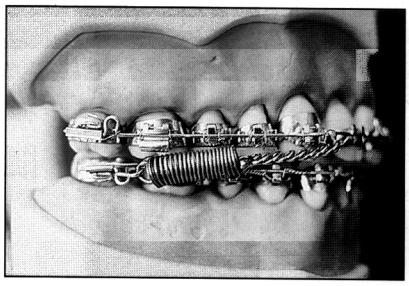
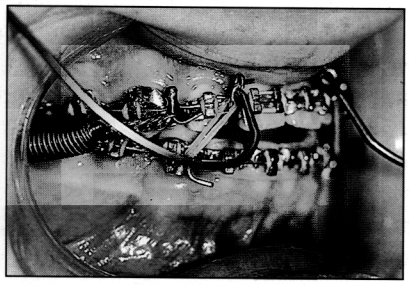
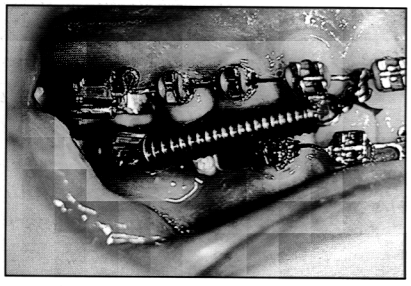


Fig 2 *(Below)* Examples of Saif springs attached, and J-hooks for high-pull headgear and elastics.







MATERIAL AND METHODS

Thirty-six growing adolescents with Class II malocclusions were selected from a private practice. These patients underwent orthodontic correction with continuous Class II elastic forces for a minimum of 6 months. Patients who were compliant used Class II elastics, while the noncompliant patients were fitted with Northwest Saif springs (Pacific Coast, Woodinville, WA, USA)[18–22] (Fig 1) that could not be removed. The Northwest Saif springs were developed by Maclay Armstrong in the 1960s.[23] Saif springs were the first orthodontic appliances developed for noncompliant patients and have been successfully employed by orthodontists since their introduction.

Each of the 36 patients was instructed in the use of a high-pull J-hook headgear to limit the extrusive effect of the Class II springs on the maxillary incisors and mandibular molars, and anterior up and down elastics that, ostensibly, would mitigate the intrusive influence of the Class II elastic force on the mandibular incisors and also their effect on the occlusal plane (Fig 2). Nineteen males and 17 females comprised this group of patients, and they ranged from 10 years 10 months of age to 15 years 2 months of age. The Frankfort-mandibular plane angles (FMA) ranged from 9 to 33 degrees. Six of the patients had no extractions, while 30 had four premolar extractions. The mean amount of time with the Class II elastic forces, measuring 10 to 12 ounces per side, was 11.19 months.

Measurements were made by superimposition on SN of starting and finishing cephalometric tracings. The measured changes were of *(1)* the FMA, which was measured with a protractor; *(2)* the occlusal plane to the mandibular plane angle, measured with a protractor; *(3)* the changes in the anteroposterior position of the mandibular incisors, determined by superimposing the lower border of the mandible and the posterior border of the symphyses of the beginning and final cephalometric tracings; and *(4)* vertical changes in the maxillary central incisors, measured by superimposing the beginning and final cephalometric tracings at the anterior nasal spine, posterior nasal spine, and posterior inferior border of the palate.

Apart from noncompliance, the arbitrary criteria used to select patients for Saif spring therapy included *(1)* mandibular incisors lingual to their desired positions; *(2)* mandibular incisors with a normal amount of attached gingival; *(3)* a low or normal mandibular plane angle (20 to 25 degrees); *(4)* an ANB angle of 6 degrees or less; and *(5)* those with prepared anchorage through full-sized edgewise archwires.

RESULTS

Frankfort-mandibular plane angle

The scattergram (Fig 3) shows that 26 (72.2%) of the patients showed no change or a decrease in the FMA. Seven other patients (19.4%) had no more than 1 degree of increase, and three patients (8.3%) displayed from 1.5 to 3 degrees of opening. Thus, 91.67% of the patients had scarcely any change in the FMA and no alteration that might have made Class II therapy more difficult. Opening of the FMA

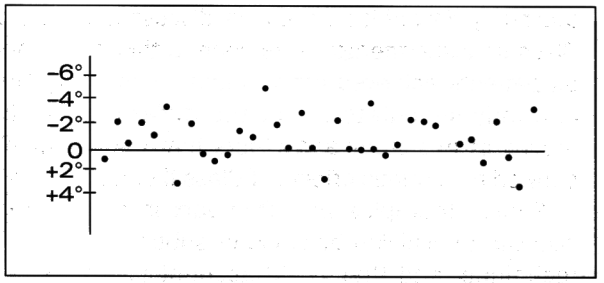


Fig 3 FMA changes. Mean, –0.763; range –5 to –3 degrees; SD, 1.741 degrees.

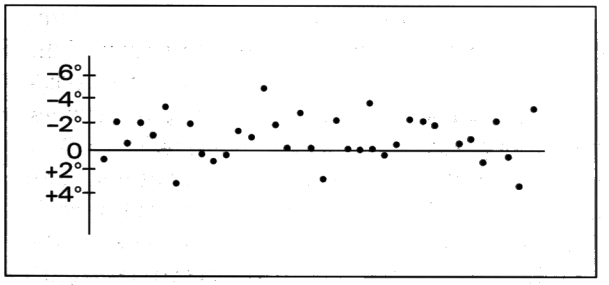


Fig 4 Horizontal changes in mandibular incisor. Mean, –2.125 mm; range, –6.5 mm to –2 mm; SD, 2.109 mm.

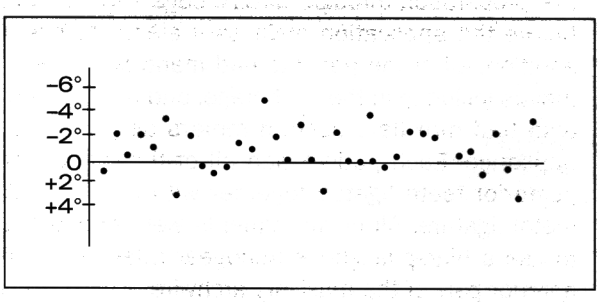


Fig 5 Vertical changes in maxillary incisor. Mean, 0.028 mm; range, –3 mm to –6 mm; SD, 1.74 mm

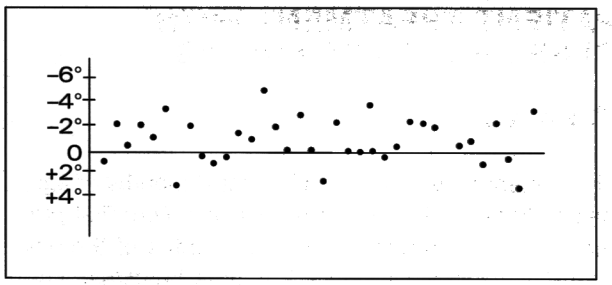


Fig 6 Occlusal plane changes. Mean –2.76 degrees; range, –2 to –8 degrees; SD, 3.108 degrees.

from Class II intermaxillary forces did not present a problem with any of these patients. This finding echoes those of Shumate[20] and Douglas,[19] who found minimal change in the mandibular plane angle of Class II patients treated with Saif springs.

Mandibular incisors

The scattergram (Fig 4) reveals that 26 (80%) of the patients displayed mandibular incisors that were either retracted or remained in their original position. Six (16.67%) of the patients showed mandibular incisors that had advanced from their original positions by 0.5 to 1 mm. Only one patient displayed mandibular incisors that had advanced from the original position as much as 2 mm. Clearly, mandibular incisor advancement does not always proceed from vigorous Class II intermaxillary forces. The question may be asked, "Was tooth sacrifice a consideration?"

Maxillary incisors

The scattergram (Fig 5) shows that 25 (69.44%) of the patients had maxillary incisors that stayed at the same level or were intruded by treatment. This intrusion could have been related to headgear wear, but there was no technique employed that would have proven either the quality or quantity of such use. No more than 1 mm of extrusion was shown by 25% of the patients.

One patient, who had worn a scoliosis brace prior to treatment, displayed 4 mm of extrusion, and one patient who had an open bite at the beginning of treatment showed central incisor elongation of 6 mm. Vigorous efforts to extrude the incisors of these patients were made to compensate for their special malocclusions. Essentially, none of the patients, other than those who therapeutically needed it, displayed significant extrusion of the central incisors by the Class II mechanics. None of the patients had excessive gingival display at the conclusion of treatment.

Occlusal plane

The scattergram (Fig 6) illustrates that 27 (75%) of the patients displayed a downward and backward tipping of the occlusal plane that averaged 2.764 degrees. The range of the tipping varied from –3 to 8 degrees, and there was a standard deviation of 3.108 degrees. Clinically, this occlusal plane tipping should have an undesirable effect. Ostensibly, this

comes from the eruptive effect of the elastic force on the mandibular molar and the depression of the mandibular incisors. Nevertheless, that had negligible clinical consequences for this group of patients. This finding echoes those of Shumate[20] and Douglas,[19] who studied the effects of continual Saif springs. Both of these authors discovered a clockwise rotation of the occlusal plane with patients who used Saif springs, but they also discovered a quick rebound, which had no permanent harmful effect.

PATIENT TREATMENT WITH CLASS II ELASTIC FORCES

Patient 1

This patient (Figs 7 to 11), 10 years 6 months of age, had a Class II, Division 1 malocclusion. Four first premolars were removed; after 15.5 months of therapy with Class II elastics and a Rampton headgear, she still had full Class II molars, a large overjet, and a deep overbite. Clearly, she had shown little cooperation.

Class II Saif springs with 12 ounces of force per side were placed, and the patient wore them for a total of 11.5 months. From the time the springs were placed, the patient experienced minimal growth and, subsequently, most of the correction came from dentoalveolar movement.

Subsequent to placement of the springs, the mandibular incisors had retracted 1 mm. After the springs, the mandibular incisors had advanced 2.5 mm and intruded 2 mm.

Patient 2

The second patient (Figs 12 to 16), 10 years 10 months of age, had a Class II, Division 1 subdivision malocclusion. His FMA of 37.5 degrees would ordinarily preclude the use of Class II elastic forces. Nevertheless, after four first premolar extractions and several months of Rampton headgear use, followed with full edgewise appliances, the occlusion was still Class II on the right side, and the patient displayed a 6.5-mm overjet.

A Saif spring was used exclusively on the right side for 5 months and a complete correction was achieved.

DISCUSSION

Few patients suffered harmful effects from the robust Class II intermaxillary elastic forces used in this study. Few of the commonly discussed effects of Class II elastic therapy were seen in this group, and all patients achieved a firm Class I occlusion. One can only speculate about the difference in the results of this study and others that have routinely showed deleterious effects of Class II elastic forces.

Similar therapies will often vary in results from clinician to clinician because of subtle variations in technique, and that could account for the differences found here. For instance, all of these patients used a 0.022-inch appliance with vigorous anchorage preparation through full-size edgewise archwires before the application of Class II elastic forces. In addition, all of the patients had mandibular second molars included in the anchorage, and many of them also had maxillary second molars as part of the appliance. Each patient had all of the mandibular posterior teeth ligated together with a figure-eight metal ligature. All of the patients were encouraged to use a high-pull J-hook headgear attached to the anterior part of the maxillary archwire, as well as up and down anterior elastics. The maxillary arches had several degrees (10 to 20 degrees) of facial crown torque placed in them and had a built-in exaggerated curve of Spee. The mandibular archwires had several degrees (5 to 10 degrees) of lingual crown torque.

A majority of these patients had premolar extractions, and that could account for the mandibular incisor retraction seen with many of them, despite the energetic use of Class II elastic forces.

Although some patients displayed extrusion of maxillary incisors and intrusion of mandibular incisors immediately following Class II elastic forces, that movement rebounded with subsequent finishing mechanics and presented no clinical problem. Shumate[20] and Douglas[19] also discovered a rebound from the extrusion of the maxillary incisors and from the intrusion of mandibular incisors.

Quessenberry[18] showed in that favorable Class II changes wrought by Saif springs were not due to mesial displacement of the mandible, and that most of the changes effected came from dentoalveolar movements. Thus, Class II forces can be expected to work with growing as well as nongrowing orthodontic patients and not cause a dual bite that will relapse with discontinuation of the force.

Until a research institute or a clinician can show a large group of Class II patients treated in an identical manner with Class II elastic forces, the specialty may have to contend with inconclusive evidence as to the ultimate effects of these mechanics. Nevertheless, this study shows that Class II elastic forces, even when used continually, do not necessarily have risky consequences.

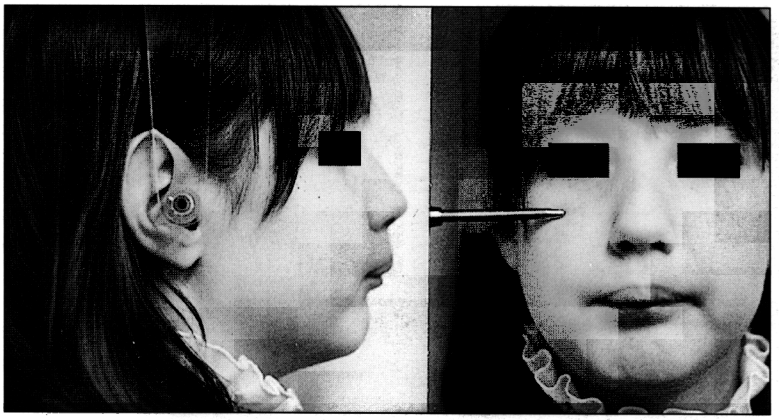


Fig 7 Patient 1. Pretreatment extraoral views.

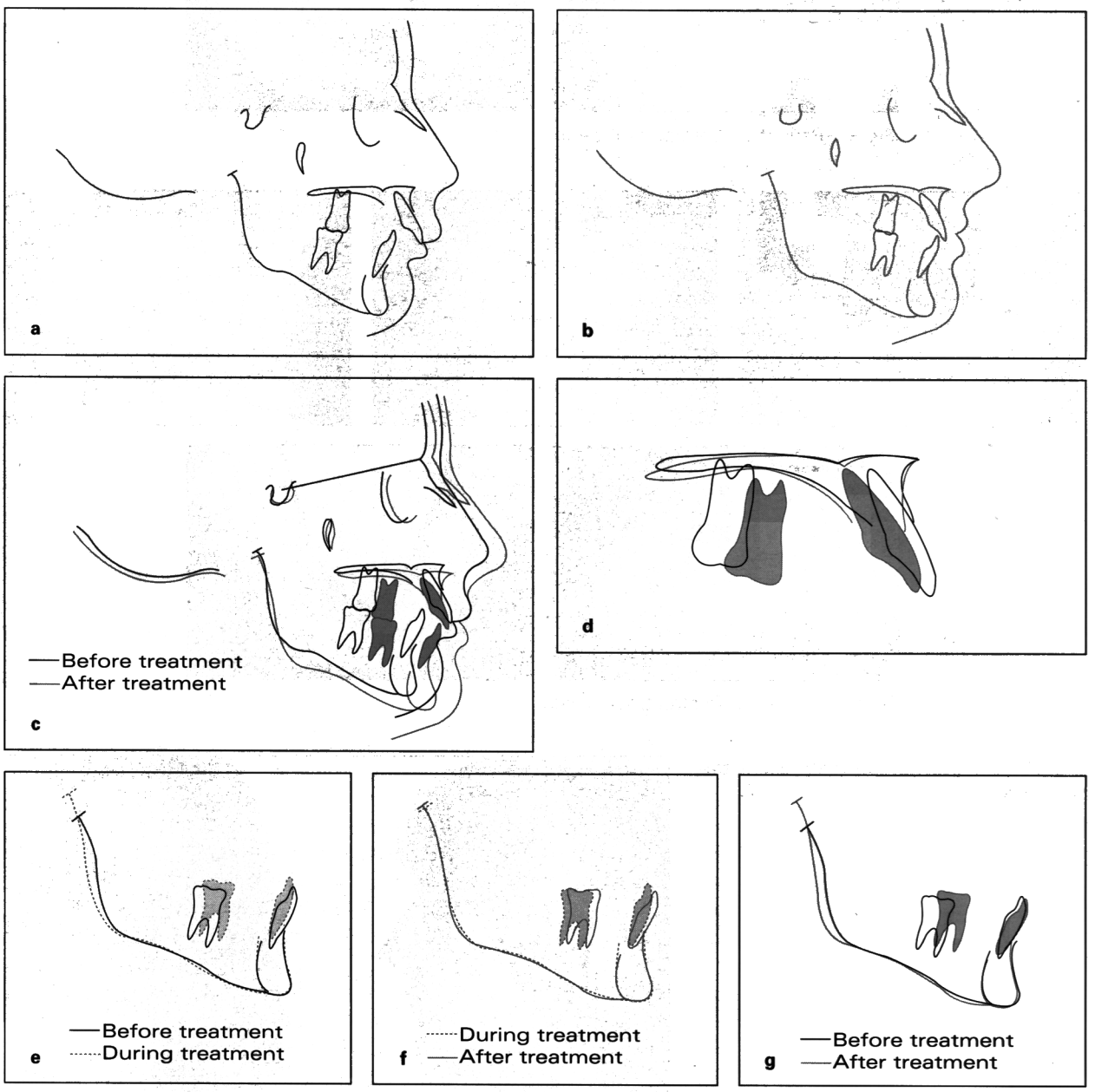


Fig 8 Patient 1. Cephalometric tracings and superimpositions. **(a)** Pretreatment. **(b)** Posttreatment. **(c to g)** Superimpositions.

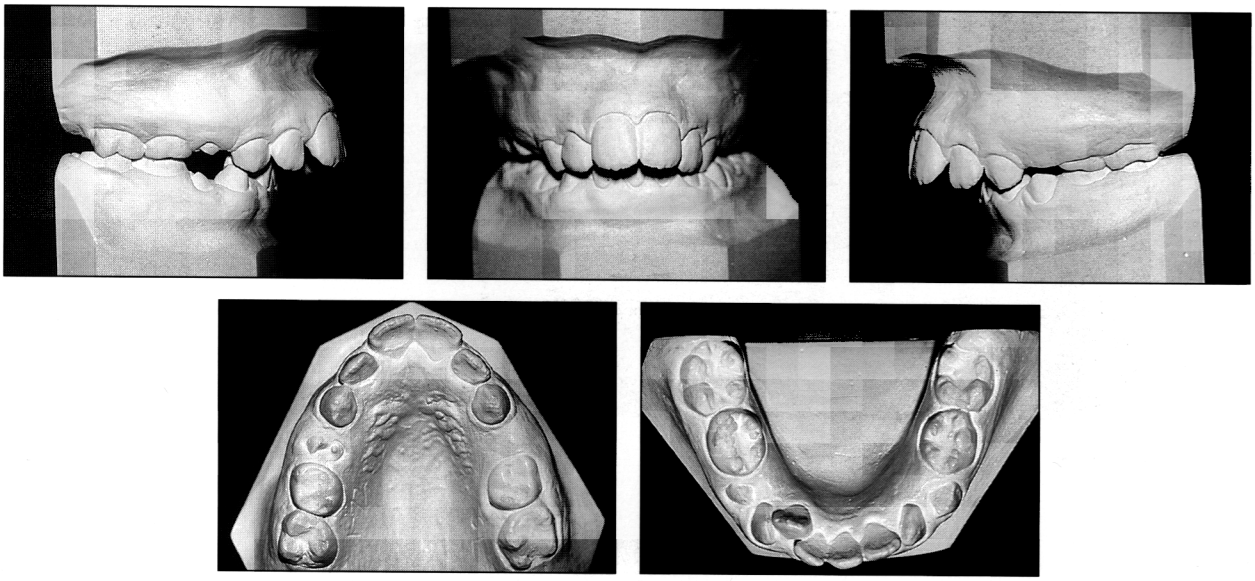


Fig 9 Patient 1. Pretreatment casts.

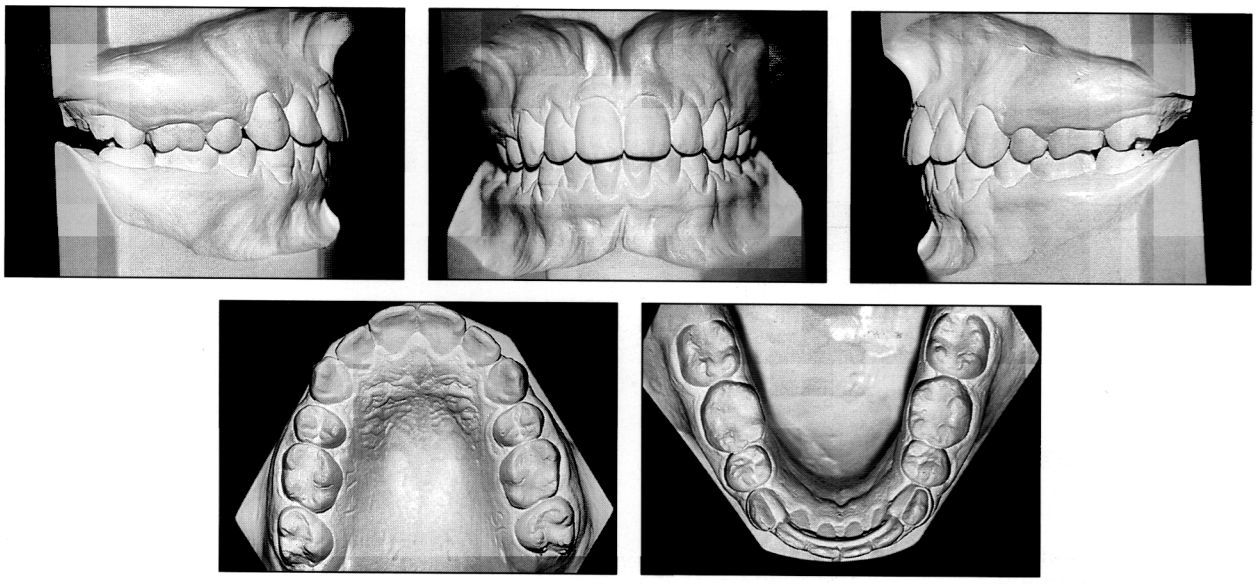


Fig 10 Patient 1. Postreatment casts.

Fig 11 Patient 1. Posttreatment extraoral views.

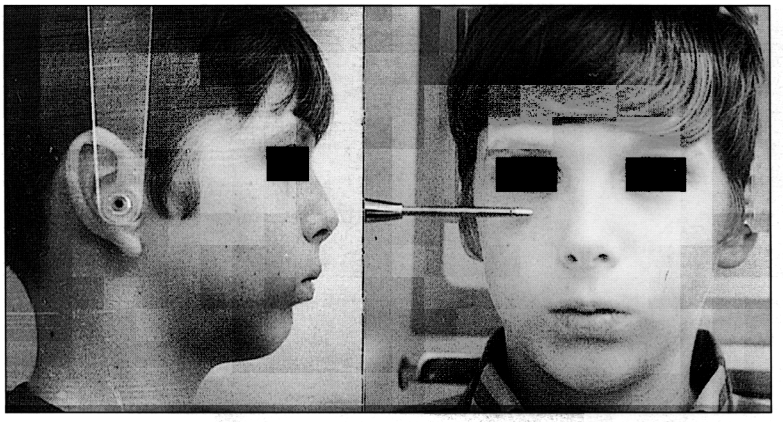


Fig 12 Patient 2. Pretreatment extraoral views.

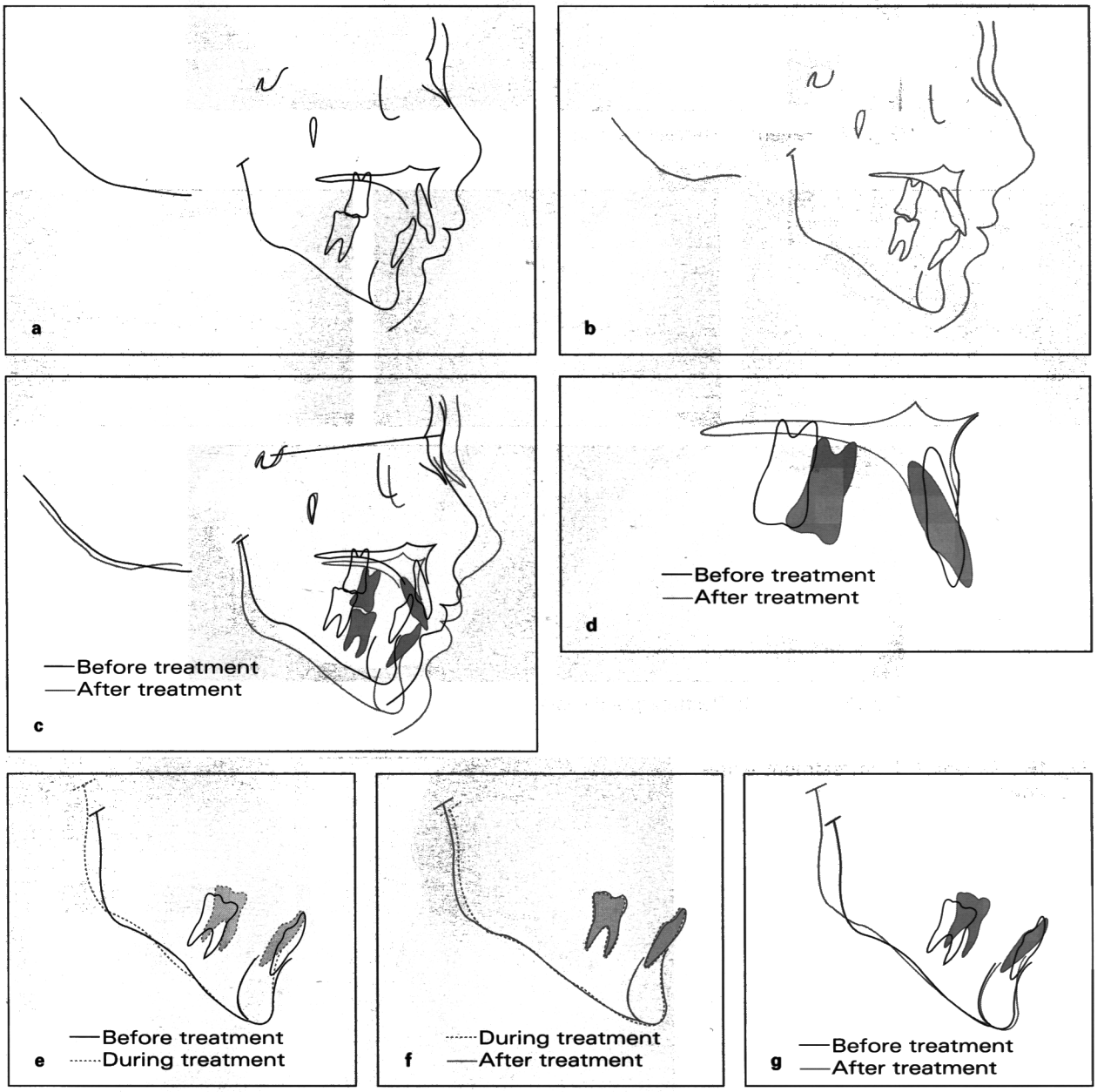


Fig 13 Patient 2. Cephalometric tracings and superimpositions. **(a)** Pretreatment. **(b)** Posttreatment. **(c to g)** Superimpositions.

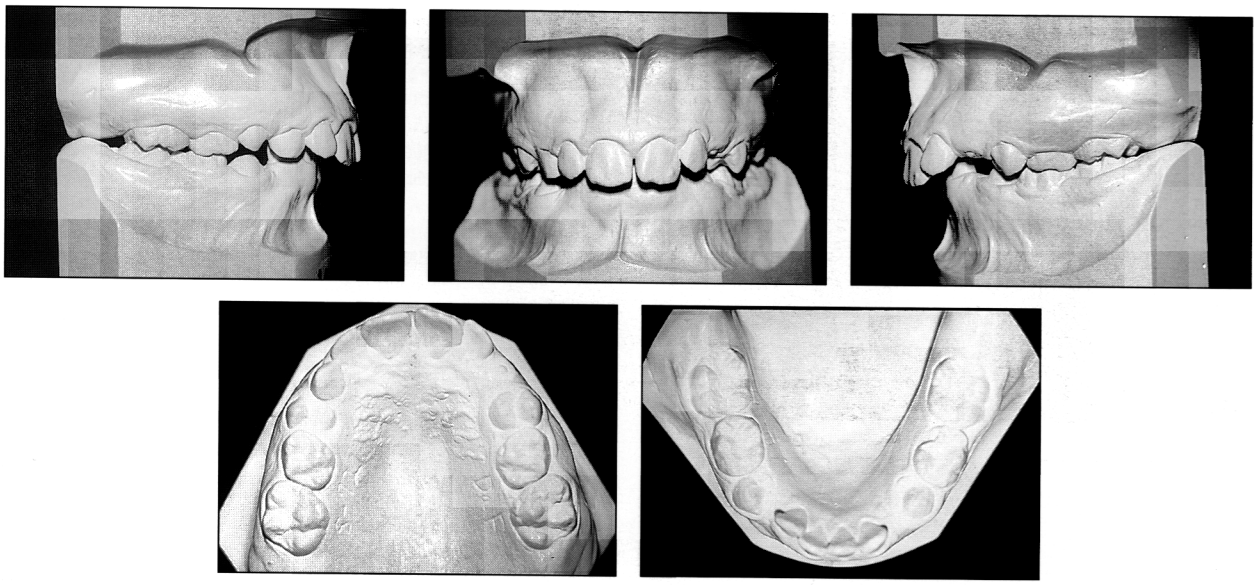


Fig 14 Patient 2. Pretreatment casts.

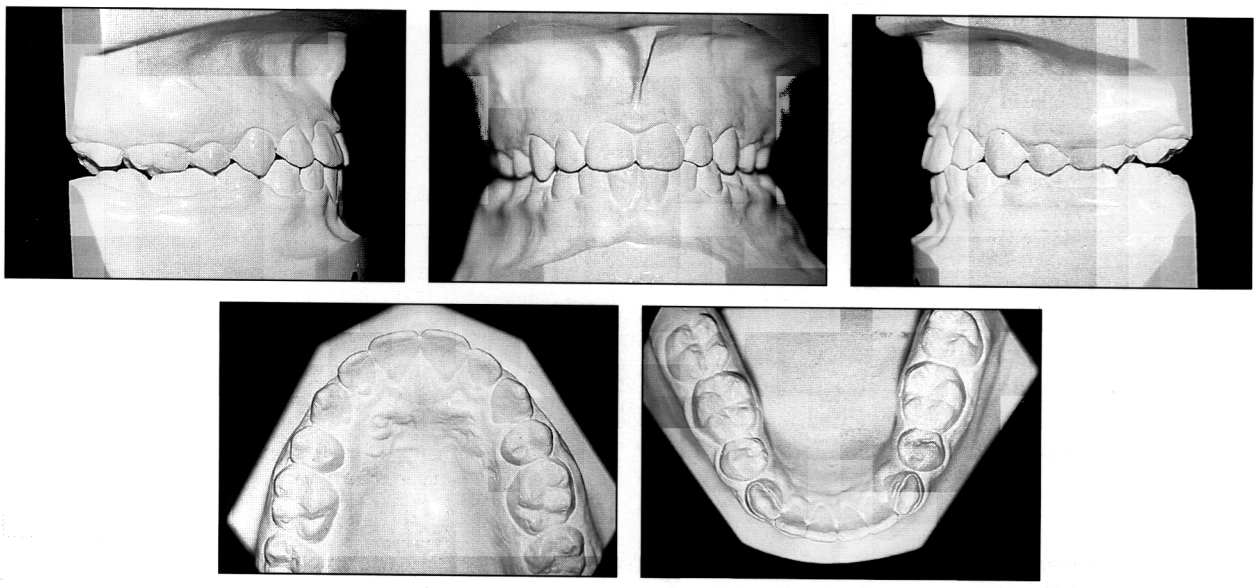
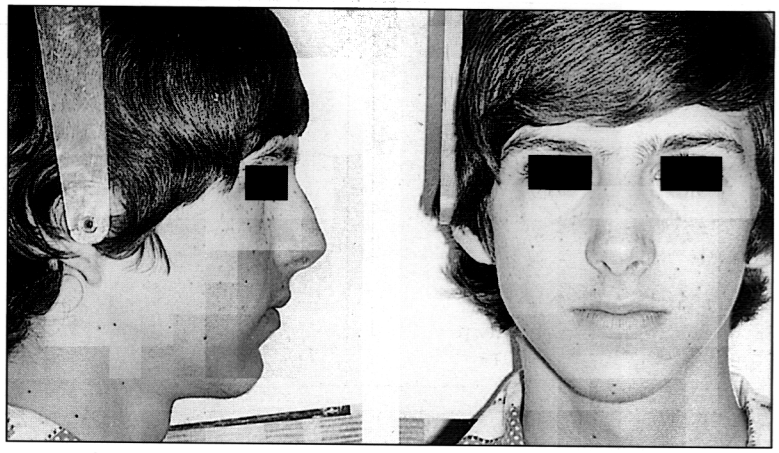


Fig 15 Patient 2. Posttreatment casts.

Fig 16 Patient 2. Posttreatment extraoral views.



CONCLUSION

Although Class II elastic forces have been an important part of orthodontic armamentarium for over a century, many clinicians display a reluctance to use them because of reported harmful effects that compromise efficient and efficacious orthodontic correction. This article is offered to neutralize those oft-repeated accusations and to illustrate conclusively that such harmful features can be diminished, if not completely eliminated, by careful planning and implementation of sound biomechanics, which may include premolar removal.

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