

Correction of Class II malocclusion with Class II elastics: A systematic review

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Introduction: Although Class II elastics have been widely used in the correction of Class II malocclusions, there is still a belief that their side effects override the intended objectives. The aim of this systematic review was to evaluate the true effects of Class II elastics in Class II malocclusion treatment. **Methods:** A search was performed on PubMed, Scopus, Web of Science, Embase, Medline, and Cochrane databases, complemented by a hand search. Study eligibility criteria were the application of Class II elastics in Class II malocclusion treatment and the presentation of dental or skeletal outcomes of treatment. All age groups were included. **Results:** The search identified 417 articles, of which 11 fulfilled the inclusion criteria. Four studied the isolated effects of Class II elastics, and 7 were comparisons between a single use of elastics and another method for Class II malocclusion correction. Because of the differences in treatment modalities in these articles, a meta-analysis was not possible. **Conclusions:** Based on the current literature, we can state that Class II elastics are effective in correcting Class II malocclusions, and their effects are primarily dentoalveolar. Therefore, they are similar to the effects of fixed functional appliances in the long term, placing these 2 methods close to each other when evaluating treatment effectiveness. Little attention has been given to the effects of Class II elastics on the soft tissues in Class II malocclusion treatment. (Am J Orthod Dentofacial Orthop 2013;143:383-92)

Class II malocclusion is a major reason that patients seek orthodontic treatment. Combinations of dental and skeletal factors ranging from mild to severe provide the multiple characters of this discrepancy.^{1,2} Among other factors, the treatment protocols can widely vary according to professional ability, malocclusion severity, and patient compliance.³⁻⁶

There are a number of orthodontic techniques and appliances to treat Class II malocclusion; among these are Class II elastics.⁷ In spite of their popularity,⁸ some authors have attributed several side effects to the use of Class II elastics—eg, loss of mandibular anchorage, proclination of mandibular incisors, extrusion of maxillary incisors, and even worsened smile esthetics because of increased gum exposure—thus suggesting minimal use of intermaxillary elastics.⁹⁻¹² Also, there is the

claim that the occlusal relationships produced might look good on dental casts but be less satisfactory from the perspective of skeletal relationships and facial esthetics. It also has been stated that Class II elastics can extrude the mandibular molars and the maxillary incisors, causing clockwise rotation of the occlusal plane and the mandible.^{11,13}

Therefore, the main objectives of this systematic review were to evaluate whether Class II elastics are effective in correcting Class II malocclusions; to determine the true dental, skeletal, and soft-tissue effects when they are used as the primary Class II anteroposterior discrepancy treatment device in the short and long terms; and to compare the results with other Class II treatment modalities.

MATERIAL AND METHODS

With the objective to determine the most frequent uses and the main effects of Class II elastics in Class II malocclusion treatment, a search was performed in PubMed, Scopus, Web of Science, Embase, Medline, and Cochrane databases, complemented by a hand search, with no date limitation (Table I). The keywords were chosen with the help of a senior librarian.

To be accepted in this review, the application of Class II elastics in Class II malocclusion treatment should have been used in the clinical studies and mentioned in the

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Table I. Database, method of search, and number of articles retrieved

Database	Search strategy*	Results	Selected
PubMed	((“malocclusion”[All Fields] AND class[All Fields] AND II[All Fields]) OR “Malocclusion, Angle Class II”[Mesh]) AND (elastic[All Fields] OR elastics [All Fields] OR “rubber”[All Fields] OR rubbers[All Fields])	117	7
Scopus	TITLE-ABS-KEY(ma*occlus* OR ma*occlus* OR malocclus* OR malocclus* AND class* OR classe* OR clase* AND 2 OR ii AND elastic OR elastics OR rubber OR rubbers)	142	7
Web of Science	TS = (ma*occlus* or ma*occlus* or malocclus* or malocclus*) AND TS = (class* or classe* or clase*) AND TS = (2 OR II) AND TS = (elastic or elastics or rubber or rubbers)	46	6
Embase	(malocclus* OR malocclus*) AND class AND ii AND (elastic OR elastics OR ‘rubber’/exp OR ‘rubber’ OR ‘rubber’/exp OR rubber OR rubbers)	4	0
Medline	(malocclus* OR malocclus*) AND class AND ii AND (elastic OR elastics OR ‘rubber’/exp OR ‘rubber’ OR ‘rubber’/exp OR rubber OR rubbers)	92	7
Cochrane	(malocclusion and class and ii and elastic) (malocclusion and class and ii and elastics) (malocclusion and class and ii and rubber) (malocclusion and class and ii and rubbers)	16	2
Total articles retrieved		417	29
Total without repetitions		162	7
Hand search			4

*Last searched in August 2010.

abstracts. By clinical studies, we meant any study conducted with patients, either retrospective or prospective. The studies should show the dental or skeletal outcomes of Class II elastics in Class II malocclusion treatment, and all age groups were included. Only articles in English were searched. The major reasons for exclusion were articles in which Class II elastics were used for purposes other than Class II correction—eg, surgical fixation, Class III surgery preparation, midline correction, open-bite correction, interdilatation, and molar extrusion. Some abstracts were retrieved simply because the author briefly commented on their use in Class II treatment or mentioned that Class II elastics were not used. These articles were also excluded.

After this primary selection and subsequent reading of the articles and evaluation of their aims by 3 blinded evaluators (R.S., T.M.F.F., and N.C.C.B.), those that dealt with causes of increased treatment time, temporomandibular dysfunction, muscle activity, apical root resorption, patient compliance indicators, anchorage preparation, laboratory studies, and atypical use or use of Class II elastics merely as an adjunct were not considered in this review because our main interest was to determine the results of clinical studies of this specific treatment procedure as the 1 protocol or when compared with other methods. Also, to raise the quality level of the studies retrieved, a minimum of 10 was established for the sample size. After this final selection, 7 articles remained from the database search^{7,11,14-18} and 4 from the hand search^{13,19-21} (Tables II and III).

With these data, the articles were analyzed and separated according to the type of study: an “elastics only” category comprised the articles in which only Class II elastics protocols were tested, and a “comparative studies” category included the use of Class II elastics compared with any other Class II treatment appliance. In this stage of the research, the outcome measures of dental, skeletal, and soft-tissue effects were evaluated. Additionally, the usage protocol, the details of its prescription, and the main results achieved with Class II elastics were quantified (Tables II and III). The accepted articles were evaluated in terms of elastic diameter, strength, appropriate archwires, prescription, treatment duration, and predominance of skeletal or dentoalveolar effects clearly resulting from the use of Class II elastics. After this analysis, 3 criteria were created to establish the article scores: sample quality, elastic usage description, and adequacy of the statistical analysis. The sample was evaluated by scoring the following 3 descriptions: malocclusion occlusal severity, sample size, and age. Elastic usage description was also evaluated by scoring 3 descriptions: strength, prescription, and mean treatment time (Table IV). For these first 2 criteria, scores were given considering the number of descriptions available in the article. If 3 descriptions were provided, the article was considered adequate; if 2 descriptions were provided, the article was considered partially adequate; and if only 1 or no description was provided, the article was considered inadequate (Table V). The last criterion, adequacy of the statistical analysis, was scored as adequate or inadequate. All these

Table II. Summarized data of the elastics only studies

Articles	Year of publication	Groups (n)	Prescription	Strength	Mean treatment time	Treatment effect	Authors' conclusion
Combrink et al ¹⁵	2006	Class II elastics only effects (35)	-	4 oz	-	SNA, -1.58° ANB, -1.68° Overjet, -3.81 mm Maxillary incisors-mandibular incisors, -21.77° Anterior nasal spine to nose point, +2.56 mm Upper lip thickness, +0.7 mm Lower lip thickness, +1.2 mm	Elastics were successful for the correction of Class II discrepancies, promoting mainly dentoalveolar effects.
Nelson et al ¹³	1999	Class II elastics only effects (18)	24 h/d	1-2 oz	-	Jaw base relationship, -1.1 mm Overjet, -5.8 mm Maxillary incisors, -3.7 mm Mandibular incisors, +1.0 mm Molar relationship, +3.0 mm Maxillary molar, 0 mm Mandibular molars, +2.0 mm Overbite, -3.0 mm Lower anterior facial height, +5.0 mm Nasion-sella line/mandibular line angle, +1.0°	The changes contributing to Class II correction were mostly dental. Vertically, the net effects of treatment were increases in the mandibular plane angle and lower anterior facial height.
Meistrell et al ²⁰	1986	Class II elastics only effects (42)	-	1-2 oz	-	Maxillary molar, +0.22 mm mesially and +2.1 mm occlusally Mandibular molar, +1.2 mm mesially and +2.6 mm occlusally ANB, -1.27° SN-Pg, +0.92° LI, +1.68 mm Holdaway soft-tissue angle, -1.48°	The maxillary first molar maintained its anteroposterior position at the same time that SNA was reduced. The mandibular first molar moved forward by 1.2 mm. Vertical changes in both the maxilla and the mandible were within normal ranges. No significant change in occlusal or mandibular plane angles was observed.
Tovstein ²¹	1955	Class II elastics only effects (81)	-	-	-	OP.SN, +4 mm in growing patients OP.SN, +7.48 mm in nongrowing patients	Patients with the greatest growth had the least change in the inclination of the occlusal plane; conversely, patients with the least growth had the greatest change in the occlusal plane. However, changes in inclination of the occlusal plane have a tendency to return to the original condition.

data were independently abstracted by 3 investigators (R.S., T.M.F.F., and N.C.C.B.) and then discussed to reach a common agreement.

Ideally, we intended to compare the effects of elastics with other Class II treatment modalities; therefore,

a meta-analysis would be recommended. However, because of the differences in the articles in the elastics only category and the different types of fixed functional appliances in the comparative studies category, a meta-analysis was not possible.

Table III. Summarized data of the comparative studies

Articles	Year of publication	Groups (n)	Prescription	Strength	Mean treatment time	Treatment effect	Authors' conclusion
Serbesis-Tsarudis and Pancherz ¹⁶	2008	Class II elastics (24) and Herbst (40)	-	2.5 oz	-	Class II elastics group: Co/RLp, -1.1 mm; Co/RL, +6.7 mm; Pg/RLp, +1.2 mm; Pg/RL, -6.0 mm; RL, -0.1°. Herbst group: Co/RLp, -2.7 mm; Co/RL, +7.5 mm; Pg/RLp, +3.8 mm; Pg/RL, -6.2 mm; RL, +0.7° (RL, a line from the incisal edge of the mandibular central incisor to the distobuccal cusp of the maxillary first molar; RLp, a line perpendicular to RL through sella)	On a long-term basis, it seems that Class II elastics and the Herbst appliance have the same effect on the mandible.
Jones et al ⁷	2008	Class II elastics (34) and Forsus (34)	24 h/d	-	-	Forsus group: mandibular molar, +1.1 mm, and molar correction, +0.8 mm, than Class II elastics group Class II elastics group: maxilla, +1.5 mm mesially; mandible, +3.8 mm mesially; maxillary molars, +0.6 mm; mandibular molars, +0.7 mm mesially; total molar change, +2.4 mm; mandibular incisors, +0.8 mm mesially; maxillary incisors-mandibular incisors, -2.8 mm of anteroposterior change	No statistically significant differences were found in the treatment changes between the groups.
Nelson et al ¹⁷	2007	Class II elastics (15) and Herbst (15)	-	-	-	Class II elastics group: overjet relapse, +1.5 mm; maxillary incisors, 2.6 mm of proclination; SNA, +1.2°; SNB, +2.3° greater than the Herbst group	The final outcome of treatment of a Class II malocclusion might be similar and independent of the orthodontic device used.
Uzel et al ¹⁸	2007	Class II elastics (15) and RMCC (15)	24 h/d	3.5 oz	8.5 mo	RMCC group: maxillary molar, +2.3 mm distalization; mandibular molar, +3.4° mesial tipping; molar relationship improvement, -4.5 mm than the Class II elastics group In both groups: increase in LFH, maxillary incisors were retroclined and retruded, mandibular incisors tipped forward, and mandibular molars extruded and mesialized	The RMCC appliance is a valuable alternative treatment method for Class II dental malocclusion in selected patients.

Table III. Continued

Articles	Year of publication	Groups (n)	Prescription	Strength	Mean treatment time	Treatment effect	Authors' conclusion
Nelson et al ¹⁴	2000	Class II elastics (18) and Herbst (18)	-	-	-	<p>Class II group: overjet, -5.2 mm; overbite, -3.5 mm; labiomental angle, +17.8°</p> <p>Class II elastics group: A-Olp, +1.3 mm; Pg-Olp, +1.6 mm</p> <p>Overjet reduction: Class II elastics group, 6.7 mm; Herbst group, 4.6 mm</p> <p>Maxillary incisors: Class II elastics group, 5.0 mm posteriorly; Herbst group, 2.2 mm posteriorly</p> <p>Mandibular incisors: Class II elastics group, proclined 1.4 mm; Herbst group, unchanged</p> <p>Molar correction: 3.2 mm in the Class II elastics group; 3.5 mm in the Herbst group</p> <p>Overbite reduction: 4.1 mm in the Class II elastics group; 2.4 mm in the Herbst group</p> <p>Lower anterior facial height: Class II elastics group, 4.2 mm; Herbst group, 3.2 mm</p> <p>Mandibular plane angle: increased 1.3° in the Class II elastics group; remained unchanged in the Herbst group</p>	The long-term results are interesting because continuing growth and development might wipe out the effects of treatment and perhaps make the 2 groups comparable again.
Ellen et al ¹¹	1998	Cortical (30) and standard (26)	-	-	-	<p>Cortical group: mandibular incisors, +2.43 mm; mandibular molar, +3.68 mm</p> <p>Standard group: mandibular incisors, +3.07 mm; mandibular molar, +3.23 mm</p>	Molar anchorage was neither enhanced nor compromised by establishing cortical anchorage.
Gianelly et al ¹⁹	1984	Fränkel (16) and headgear (17) and Class II elastics (16)	-	-	-	<p>Class II elastics group: SNA, -0.37°; SNB, +0.34°; NSGn, +0.81°; SNGoGn, +1.25°; face height (N-M), +6.12 mm; Ar-Gn, +2.9 mm; pogonion, +1.62 mm</p>	The results indicate no treatment response that is uniquely related to a specific technique.

Table IV. Study characteristics

Articles (y)	Sample description	Elastic usage description
Serbis-Tsarudis and Pancherz ¹⁶ (2008)	Occlusal severity description: at least ½ cusp Class II Sample size: 64 Age: 12.3 y (elastics) and 12.4 y (Herbst)	Strength: 2.5 oz Prescription: - Mean treatment time: -
Jones et al ⁷ (2008)	Occlusal severity description: at least end-on Class II Sample size: 68 Age: 12.2 y (elastics) and 12.6 y (Forsus)	Strength: - Prescription: 24 h/d Mean treatment time: -
Nelson et al ¹⁷ (2007)	Occlusal severity description: - Sample size: 30 Age: 13.7 y (elastics) and 13.5 y (Herbst)	Strength: - Prescription: - Mean treatment time: -
Uzel et al ¹⁸ (2007)	Occlusal severity description: - Sample size: 30 Age: 11.4 y (elastics) and 13.2 y (RMCC)	Strength: 3.5 oz Prescription: 24 h/d Mean treatment time: 8.5 months
Combrink et al ¹⁵ (2006)	Occlusal severity description: - Sample size: 35 Age: 10-15 y (elastics only)	Strength: 4 oz Prescription: - Mean treatment time: -
Nelson et al ¹⁴ (2000)	Occlusal severity description: - Sample size: 36 Age: 13.5 y (elastics) and 13.7 y (Herbst)	Strength: - Prescription: - Mean treatment time: -
Nelson et al ¹³ (1999)	Occlusal severity description: - Sample size: 18 Age: 13.5 y (elastics only)	Strength: 1-2 oz Prescription: 24 h/d Mean treatment time: -
Ellen et al ¹¹ (1998)	Occlusal severity description: - Sample size: 56 Age: 11 y 1 mo (cortical anchorage) and 12 y 7 mo (standard edgewise)	Strength: - Prescription: 8.3 months full time and 2.7 months part time for cortical anchorage; 8.8 months full time and 2.6 months part time for standard edgewise Mean treatment time: -
Meistrell et al ²⁰ (1986)	Occlusal severity description: cusp to cusp to full Class II Sample size: 42 Age: 12 y 9 mo (elastics only)	Strength: 1-2 oz Prescription: - Mean treatment time: -
Gianelly et al ¹⁸ (1984)	Occlusal severity description: - Sample size: 49 Age: 10 y 9 mo (Frankel) and 10 y 11 mo (headgear) and 11 y 11 mo (elastics)	Strength: - Prescription: - Mean treatment time: -
Tovstein ²¹ (1955)	Occlusal severity description: - Sample size: 81 Age: 10-21 y (elastics only)	Strength: - Prescription: - Mean treatment time: -

RESULTS

In total, 417 articles were retrieved. Starting from PubMed, a comparison between bases was made to eliminate duplicated articles. As a result, 162 articles were retrieved from these databases.

Among the 162 retrieved articles, 11 dealt with clinical studies of Class II elastics applied in Class II malocclusion correction. When we separated the articles based on the type of study, 4 articles fell into the category of elastics only, with Class II elastics used to treat Class II malocclusions without other treatment appliances or protocol, and 7 were comparative studies in which primarily Class II elastics were compared with another appliance or protocol for Class II malocclusion treatment (Tables II and III).

The most frequent ways of use of, and the main effects caused by, Class II elastics in Class II malocclusion treatment were evaluated in each retrieved and accepted article. Only 1 article described the elastic diameter used: 3/16 in.¹⁵ The forces applied were given in 5 articles (1-2,^{13,20} 2.5,¹⁶ 3.5,¹⁸ and 4¹⁵ oz), and the mean force was 2.6 oz (73.7 g). The wire dimensions were described in only 2 articles; both applied Class II elastics on 0.016 × 0.022-in stainless steel wires^{15,18} in an 0.018-in slot bracket.¹⁵ The prescriptions were described in only 3 articles that required full-time wear.^{7,13,18} Duration of active treatment with Class II elastics was mentioned in only 1 article (8.5 months).¹⁸ One article found a tendency of predominantly skeletal effects consequent to the use of Class

Table V. Study characteristics

Article (y)	Sample*	Elastics usage [†]	Statistical analysis
Serbesis-Tsarudis and Pancherz ¹⁶ (2008)	Adequate	Inadequate	Adequate
Jones et al ⁷ (2008)	Adequate	Inadequate	Adequate
Nelson et al ¹⁷ (2007)	Partial	Inadequate	Adequate
Uzel et al ¹⁸ (2007)	Partial	Adequate	Adequate
Combrink et al ¹⁵ (2006)	Partial	Inadequate	Inadequate
Nelson et al ¹⁴ (2000)	Partial	Inadequate	Adequate
Nelson et al ¹³ (1999)	Partial	Partial	Adequate
Ellen et al ¹¹ (1998)	Partial	Inadequate	Adequate
Meistrell et al ²⁰ (1986)	Adequate	Inadequate	Adequate
Gianelly et al ¹⁹ (1984)	Partial	Inadequate	Adequate
Tovstein ²¹ (1955)	Partial	Inadequate	Adequate

*Malocclusion occlusal severity description, sample size, and age; [†]Description of strength, prescription, and mean treatment time.

II elastics.⁷ Five found predominant dentoalveolar effects^{13-16,18} (Tables II and III).

Elastics only

For more consistent data on the true dentoalveolar effects produced by Class II elastics, only the articles in the elastics only category were analyzed. This was done to eliminate bias from comparisons of elastics with other appliances. Therefore, the effects could only have been due to the exclusive use of Class II elastics. Forward maxillary growth appeared to be restrained, and the maxillary molars did not move significantly. Conversely, forward growth of the mandible occurred, and the mandibular first molars moved 1.2 mm forward. The mandibular incisors were proclined.^{13,20} During the total treatment period, overjet reduction was 5.8 mm. There were 18.9% of skeletal and 71.1% of dental changes. Overbite reduction in the total treatment period was 3.0 mm, and molar correction was 3.0 mm: the dental changes comprised 1.9 mm (63%) and the skeletal, 1.1 mm (37%). Mandibular growth exceeded maxillary growth by 1.1 mm. The lower anterior face height increased by an average of 5.0 mm.¹³ The occlusal plane angle increased during treatment but had a tendency to return to the original condition later.^{13,15,20,21} These combined effects contributed to correction of the Class II malocclusions. Hence, Class II elastics are effective in correcting Class II malocclusions, and their effects are mainly dentoalveolar. Soft-tissue effects were vaguely mentioned by these articles, and few variables were dedicated to this subject. Only 2 articles evaluated these effects, reporting increases of upper and lower lip thicknesses of 0.7 and 1.2 mm, respectively,¹⁵ and a reduction of 1.48° of the Holdaway soft-tissue angle.²⁰

Comparative studies

The comparative studies in which Class II elastics were exclusively used and compared with another Class

II treatment appliance produced the most interesting results. When Class II elastics were compared with the Fränkel function regulator, headgear,¹⁹ the cortical anchorage principle,¹¹ and the Forsus appliance⁷ to correct Class II malocclusions, no differences were found in the changes produced by these approaches.

In the short term, the Herbst appliance achieved greater skeletal changes than did Class II elastics. The Herbst appliance corrected the overjet with 51% of skeletal changes, whereas Class II elastics produced only 4% of skeletal correction. In the molar relationships, the Herbst achieved 66%, and Class II elastics achieved 10% of the skeletal correction. However, the authors suggested that, when the posttreatment time period is longer (2-3 years), the amount of natural growth increases, and this could mask the effects of the appliances, wiping out the effects of treatment and perhaps making the 2 groups comparable again.¹⁴

Comparison of the results between Class II elastics and the reciprocal mini-chincup appliance in Class II malocclusion treatment showed that overjet correction resulted mainly from dentoalveolar changes with both devices, and molar correction was 87.36% dentoalveolar for the reciprocal mini-chincup appliance and 51.47% for Class II elastics.¹⁸ Both devices achieved a Class I molar relationship, with 4.5 mm of molar correction in the reciprocal mini-chincup group and only 2 mm for the Class II elastics group. Other skeletal and dental changes were similar in both groups.

Summarizing the findings of the comparative studies showed that, on a long-term basis, there are no significant differences between the effects of Class II elastics and other removable or fixed functional appliances in Class II malocclusion treatment.

DISCUSSION

The aim of this systematic review was to obtain every article on Class II elastics published in PubMed, Scopus,

Web of Science, Embase, Medline, and Cochrane databases, and by hand searching. This sort of review reduces the tendency to favor 1 particular point of view and allows acquiring all data published in the most respected journals, indexed in these databases.

From the 162 retrieved articles, only 11 met the final criteria and were selected for this review. With these data, we determined that sample descriptions and details in the use of Class II elastics have been omitted by most authors. Sample description such as mean age is important to understand the results obtained, and the sample size is important to be able to determine the validity of the results and conclusions. All 11 of the accepted articles described the subjects' mean ages and the numbers of patients comprising the samples. Conversely, only 3 articles described the Class II malocclusion occlusal severity in the samples; this allows a more precise evaluation of the occlusal effects of the elastics.^{7,16,20} Identification of the occlusal malocclusion severity is essential to characterize the sample, describe the treatment difficulty of the patients, and, most importantly, determine the best treatment approach.⁶ Additionally, only 6 articles described at least 1 aspect of Class II elastic use (Table IV).^{7,13,15,16,18,20} Consequent to the few articles that described these details, there are no significant data to be able to determine the most convenient protocols to correct Class II malocclusion with Class II elastics. For this reason, it can only be stated that the current literature suggests using light forces (average, 2.6 oz) obtained with a 3/16-in diameter elastic and a rectangular 0.016 × 0.022-in stainless steel archwire. Because Class II elastics heavily rely on patient compliance, full-time usage is recommended. Within an average period of 8.5 months, correction of the Class II discrepancy is usually obtained with predominant dentoalveolar effects (Tables II and III). Because malocclusion severity was specified in only 3 articles to be at least an end-to-end Class II malocclusion, it can be speculated that this is the treatment time to correct an end-to-end Class II malocclusion or less.^{7,16,20} Additionally, little attention has been given to the soft-tissue effects caused by this treatment modality. Therefore, research on this topic is necessary to determine the soft-tissue impact caused by Class II elastics used in Class II malocclusion treatment. Finally, because Class II malocclusions might result from combinations of dental and skeletal factors ranging from mild to severe, the effects described here apply to general Class II malocclusions and not to specific types.^{1,2} Further investigations on each type are necessary.

Elastics only

Overall, the use of Class II elastics in Class II malocclusion correction produced primarily dentoalveolar effects (Tables II and III).^{13-16,18} These results seem to be reasonable because of the relatively light force applied (73.7 g)^{13,15,16,18,20} during a mean period of 8.5 months,¹⁸ with an average recommended use of 24 hours per day.^{7,13,18} Usually, skeletal changes are generally produced by appliances that apply heavier forces during longer periods of time.²²⁻²⁴

No study has emphasized any collateral effects produced by the elastics, as previously suggested.⁹⁻¹² Therefore, Class II elastics are also a valuable tool that can be used either alone or with other appliances to correct Class II malocclusions, without significant side effects.

Comparative studies

Complementing the previous results, the comparative studies showed that the changes produced by Class II elastics are similar to those produced by functional appliances in the long term.^{16,17} In the short term, the Herbst appliance achieved greater skeletal changes than did Class II elastics.¹⁴ This difference is most probably because the Herbst appliance is fixed and therefore acts continuously for 24 hours a day, whereas the elastics act only when placed in position. Although elastics can be recommended to be used up to 24 hours per day, it is likely that patients use them only about half of the recommended time, as with functional appliances.²⁵ These studies have shown not only that Class II elastics are effective in correcting Class II malocclusions but also that the changes produced by these devices are similar to those of functional appliances. Consequently, Class II elastics are definitely an additional option to correct Class II malocclusions.

However, most studies included in this systematic review were retrospective. Retrospective studies are not ideal, but, in the absence of stronger evidences, they can provide satisfactory information to guide our clinical procedures.²⁶⁻²⁹ All age groups were included because age limitations would also decrease the number of suitable articles. By current standards, these can be serious limitations of the review. Therefore, for now, we must accept that these changes are the actual effects of Class II elastics in Class II malocclusion treatment, and that they are similar to those with either removable or fixed functional appliances, until future prospective randomized or controlled investigations can confirm them. Selection criteria of the studies were as restricted as possible to include

fairly good investigations and the best studies on the topic. Increasing the criteria severity to require only randomized prospective or controlled studies would not have allowed inclusion of a single article. Scientific methodologies have improved in recent years; consequently, not many articles have a high quality level, based on current standards, for a specific subject.³⁰

The use of Class II elastics in Class II malocclusion correction is a controversial issue, with much emphasis on their side effects.⁹⁻¹² Therefore, to elucidate this issue, our intention in this systematic review was to show the level of evidence regarding the changes that can be obtained with these devices and also how they compare with other Class II treatment modalities. Randomized clinical trials comparing Class II elastics with functional appliances in Class II malocclusion correction are necessary to provide more detailed information on the effects of these devices.

Clinical implications

The belief that functional appliances have mainly skeletal effects, compared with Class II elastics, is not based on strong scientific evidence. Some authors have stated that little evidence supports the claim that functional appliances significantly affect mandibular growth, especially in the long term.^{31,32} Others have stated that the most significant treatment effects of functional appliances are restricted to dentoalveolar changes.^{16,33} The articles that we evaluated showed more similarities than differences between these 2 treatment devices.

After analysis of the accepted articles, it became clear that further research is needed to clarify the permanent skeletal effects of functional appliances in Class II malocclusion treatment.³¹ It seems that the well-known orthopedic effects³⁴ produced by this treatment protocol do not last over the years.^{14,16,35} Because of these findings and based on this systematic review, it is possible to state that, in the long term, there are no relevant differences between treatment effects produced by functional appliances and Class II elastics, since both protocols have a predominance of dentoalveolar effects as an enduring result. Again, as previously stated, these results apply to Class II malocclusions in general and not to specific types.

It was not our intention to defend the indiscriminate use of Class II elastics in Class II malocclusion treatment but only to elucidate that there is no strong evidence that they have mainly side effects, as previously suggested.⁹⁻¹² There is still a need for a detailed description of Class II elastics protocols of usage: eg, diameter, strength, prescription, appropriate wire, and periods of wear. The importance of overcorrection,

active retention, and differential growth, which are relevant issues about the stability of the results, are sometimes disregarded by our scientific community.³⁶ Although these are speculations, we can at least state that, on a long-term basis, Class II elastics have similar effects to other methods for Class II malocclusion treatment, such as fixed functional appliances, contrasting with the common belief that these appliances promote greater skeletal effects than do Class II elastics. This systematic review demonstrated that these differences are diminished by time.

CONCLUSIONS

Class II elastics are effective in correcting Class II malocclusions, and their effects are mainly dentoalveolar, including lingual tipping, retrusion, and extrusion of the maxillary incisors; labial tipping and intrusion of the mandibular incisors; and mesialization and extrusion of the mandibular molars. Little attention has been given to the soft-tissue effects of this treatment modality.

These effects are similar on a long-term basis to those produced by functional appliances; this places these 2 methods close to each other when evaluating treatment effectiveness.

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