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Clinical case

Orthodontic Treatment of a Class I Patient Using Self-Ligating System

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ABSTRACT

Introduction: Teeth malocclusion is a disability with a potential impact on mental and physical health. Regarding the etiology, it is commonly caused by a distortion of normal development. **Objective:** To present the orthodontic management of a class I patient with a passive self-ligation system. **Case presentation:** 11-year-old female patient, mesofacial, straight profile, skeletal class I, molar class I, canine class not established, 6.4 mm upper crowding and 7.73 mm lower crowding, 5 mm overbite, and 2 mm overjet. Oral breather and onychophagia. Treatment was performed with passive self-ligating system brackets. In the alignment and leveling phase, Damon® Q brackets were placed in the upper and lower arch and 0.014" CuNiTi arches, class II elastics with

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24 hours of use were indicated. Buildups were placed in the upper first molars. The work phase was started with a 0.016 x 0.022" SS lower arch and was finalized with 0.019 x 0.025" SS arches. Finally, appliance removal and retention placement were performed. As for results, the facial profile was maintained, crowding was eliminated, correct overjet and overbite were obtained, molar class I was obtained, and canine and anterior guidance were established. The curve of Spee was eliminated, and arches were coordinated, obtaining the patient's complete satisfaction. **Conclusion:** Decision-making in the treatment plan for patients with class I malocclusion must consider various characteristics, such as the patient's profile, incisor inclination, and lower facial height. In the present case, all the characteristics presented were adequate to perform a treatment without extractions which was confirmed by the results obtained.

Keywords: class I, moderate crowding, self-ligating system.

INTRODUCTION

Malocclusion of the teeth is not a disease; it is a disability with a potential impact on mental and physical health because it can affect facial aesthetics and therefore can also damage self-esteem and quality of life. Patients show more interest in aesthetic and social aspects as a reason to seek orthodontic treatment. Regarding etiology, most of the time malocclusion and dentofacial deformity are not due to pathological processes, but to a distortion of normal development[1,2]. The most common type of malocclusion seen in the mixed dentition is crowding. These patients have an obvious dentoalveolar protrusion or lack of space for eruption of the permanent teeth. Most commonly, these patients have a Class I molar relationship[1]. According to a systematic review of the global distribution of malocclusion, Angle's[3] Class I malocclusion in permanent dentition is the most prevalent, accounting for 74.7% of the total population studied, as well as in the mixed dentition with a percentage corresponding to 72.4%. Angle[3] describes class I malocclusions as normal molar relationships (in class I) and teeth with crowding and rotations.

The treatments of choice for moderate and severe crowding in the late mixed dentition are transverse expansion and extractions[4]. Trends in practice have recently focused on not performing extractions due to concerns regarding temporomandibular joint pain, facial esthetics, and demand from patients seeking the appearance of more prominent lips and a more youthful appearance[5-7]. Maxillary expansion can be used to achieve arch perimeter augmentation to alleviate moderate dental crowding, arch size length discrepancies and facilitate treatment without extractions[8].

The philosophy of the passive self-ligation system is based on the principle of using sufficient force to initiate tooth movement, but this must be low enough to prevent occlusion of the blood vessels in the periodontal ligament and thus allow the cells and various chemical messengers to be transported to the site where bone resorption and apposition will occur, thus allowing tooth movement[9]. Passive self-ligating brackets reduce frictional resistance and have advantages such as clinical efficiency due to the ease of changing archwires and slide opening[10].

CLINICAL CASE PRESENTATION

An 11-year-old female patient with no relevant medical history came to the orthodontic clinic of the Universidad de Guadalajara with the reason for consultation *"My teeth are crooked"*. Her facial biotype was mesofacial, proportionate thirds, diminished outer fifths, augmented middle fifth; straight profile, and coincident facial midline and dental midlines (Figure 1), skeletal class I (Table 1).

Figure 1. Initial extraoral and intraoral photographs.

In the intraoral analysis (Figure 1) there were coincident midlines, right and left molar class I, bilateral non-assessable canine class, anterior crowding, and a curve of Spee of 3 mm. Upper crowding was 6.4 mm and lower, 7.73 mm (Figure 2). Overbite was 5 mm, with an overjet of 2 mm. Parabolic arch forms. Functionally she was diagnosed as an oral breather and presented onychophagia. She did not have alterations in the TMJ. The orthopantomography showed a good (Figure 3) crown-root ratio. Almost all the permanent teeth were present with the exception of teeth 23 and 25 and the germs of the third molars, primary teeth 63, 65, upper and lower premolars, and cuspids were undergoing apical formation. In the lateral head film as well as in the cephalometric tracing performed with Dolphin 9.0 software (Figure 3) we observed permeable airways, a short mandibular ramus, a long mandibular body, and a straight profile. The treatment objectives were to maintain the profile, eliminate crowding, correct overjet and overbite, maintain molar class I and establish canine and anterior guidance, eliminate the curve of Spee, and coordinate arches.

A treatment plan was established without extractions and the use of Damon® Q appliances with low torque in the upper and lower arches, tubes in the first and second molars, and placement of turbobites in the upper first molars. In the alignment and leveling phase, the use of 0.014" CuNiTi and 0.018" CuNiTi archwires was planned. as well as the use of 0.014" x 0.025" CuNiTi and 0.018" x 0.025" CuNiTi archwires and ¼" 2 Oz short class II elastics. Subsequently, the patient was scheduled for an orthopantomography to check the root parallelism and the use of ¼" 4.5 Oz CII elastics was continued. In the working phase it was planned to place an upper 0.019" x 0.022" SS archwire with crimpable or soldered tubes and a 0.017" x 0.025" SS lower archwire with CII elastics and stripping in the lower arch. In the finishing phase, retention was planned with an upper Essix retainer and a lower part fixed from canine to canine.

Tabla 1.
Initial and final Ricketts cephalometric values of the patient cephalometry.

	NORMAL VALUE 8 ½ years - 9 years	INITIAL	FINAL
FIELD I- DENTAL PROBLEM			
Molar ratio	-3mm ± 3mm	1 mm	-1.6
Incisor *overjet*	2.5 mm ± 2.5 mm	1 mm	4 mm
Incisor *overbite*	2.5mm ± 2 mm	4 mm	3 mm
Lower incisor extrusion	+1.25mm ± 2mm	3 mm	1.5 mm
Inter-incisive angle	130° ± 10°	127°	116°
FIELD II- MAXILLOMANDIBULAR			
Convexity	2mm ± 2mm	4 mm	3 mm
Lower facial height	47° ± 4°	42°	42.1°
FIELD III- DENTO-SKELETAL			
Upper molar position	Age + 3mm ± 3mm	14 mm	
Lower incisor protrusion	+ 1mm ± 2mm	1 mm	6 mm
Upper incisor protrusion	+ 3.5mm ± 2mm	6 mm	10 mm
Lower incisor inclination	22° ± 4°	20°	33.8°
Upper incisor inclination	28° ± 4°	22°	30.5°
FIELD IV- AESTHETIC PROBLEM			
Lip protrusion	-2mm ± 2mm	+1 mm	1 mm-1.6
FIELD V- CRANIOFACIAL RELATIONSHIP			
Facial depth	87° ± 3°	88.5°	88.5°
Facial axis	90° ± 3°	88.5°	92.4°
Facial taper	68° ± 3.5°	62°	60°
Mandibular plane angle	26° ± 4°	30°	31.6°
Maxillary depth	90° ± 3°	92°	92°
Maxillary height	53° ± 3°	63°	53.8°
Palatal plane	1° ± 3,5°	1°	3.8°
FIELD VI- INTERNAL STRUCTURE			
Cranial deflection	27° ± 3°	28°	23.5°
Anterior cranial length	55mm ± 2.5mm	58 mm	58.4 mm
Posterior facial height	55mm ± 3mm	61 mm	62.7 mm
Ramus position	76° ± 3°	70°	71°
Location of the Porion	-39mm ± 2mm	-39 mm	-39.3 mm
Mandibular arch	26° ± 4°	37°	45.4°
Mandibular body length	65mm ± 2.7mm	72 mm	96.9 mm

In the alignment and leveling phase, Damon® Q *brackets* were placed in the upper and lower arch and 0.014" CuNiti archwires for 4 months, including tubes in the upper and lower first and second molars. The patient was instructed to wear CII ¼" 2.5 Oz elastics 24 hours a day. Subsequently, the archwires were changed to 0.018" CuNiTi and the use of CII ¼" 2.5 Oz elastics was maintained. *Buildups* were placed on teeth #16 and #26, and an *open coil* on teeth 15 and 33 (Figure 4). One month later, a button was placed on tooth 15 with elastic thread (Figure 5).

Figure 2. Study models.

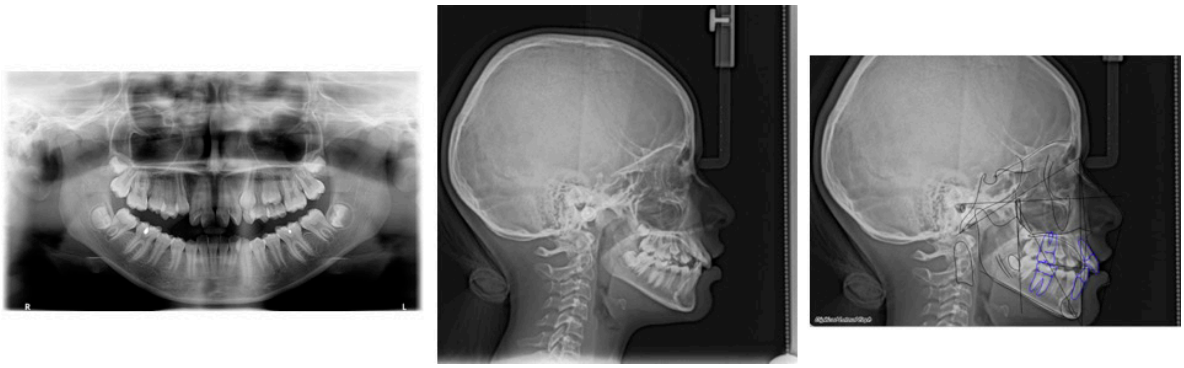

Figure 3. Orthopantomography, lateral headfilm, and initial cephalometric tracing.

After one month, tooth 15 was included and a button was placed on tooth 33 with *open coil* activation and elastic thread. At the next appointment, the lower arch was changed to a 0.014" CuNiti, and tooth 33 was included (Figure 6). The lower arch was changed to a 0.018" CuNiti and a radiograph was taken. After two months the archwires were changed to 0.014" x 0.025" CuNiTi and the use of CII elastics was continued. The work phase began with the change of the lower arch to 0.016" x 0.022" SS and the order to extract tooth #65. Two months later, *brackets* were placed on teeth 23 and 25, and the upper arch was changed to 0.014" x 0.025" CuNiTi. The use of CII 5/16" 4 Oz elastics 24 hours a day was indicated and an orthopantomography was requested.

Figure 4. 0.018" NiTi upper and lower archwires, ¼" 2.5 Oz. CII elastics, *open coil* between teeth 15 and 33, turbo bites on upper first molars.

Figure 5. 0.018 NiTi upper and lower archwires, *open coil* between teeth 33 and 15, button on tooth 15 with elastic thread.

The radiograph was reviewed and *brackets* were not repositioned because the roots were in good position. The archwires were changed to 0.018" x 0.025" NiTi upper and lower and the use of elastics was continued. Upper canine to canine were tied together with ligature wire and the upper archwire was changed to 0.019" x 0.025" SS, with the arch form of the 0.018" x 0.025" NiTi. Elastics were worn only at night. The lower arch was changed to a 0.019" x 0.025" SS, with CII elastics. Afterwards, the lower arch was changed back to a 0.018" x 0.025" NiTi because the *bracket* of tooth 31 was detached and broken. Night-time elastics were suspended. The patient presented tooth 31 rotated because the slide opened, so we lowered the archwire to a 0.014" x 0.025" CuNiTi. *Brackets* were removed in the upper arch, an impression was taken for an

Figure 6. 0.018" CuNiti upper archwire, 0.014" CuNiti in the lower arch, including tooth 33.

Essix-type retainer, *stripping* was performed in mesial and distal of tooth 31 and it was ligated with ligature wire.

For retention, an upper Essix was placed. After one month, the lower *brackets* were removed and a fixed retainer was placed from canine to canine. An impression was taken for an Essix and it was placed after 3 days (Figure 6). An interconsultation with maxillofacial surgery was performed to remove the third molars.

The following treatment results were achieved: the facial profile was maintained, crowding was eliminated, correct *overjet* and *overbite* were obtained, molar class I was maintained, canine class I was obtained, and canine and anterior guidance were established. The curve of Spee was eliminated, arches were coordinated and the patient was completely satisfied (Figures 7 and 8, Table 1).

Figure 7. Final extraoral and intraoral photographs.

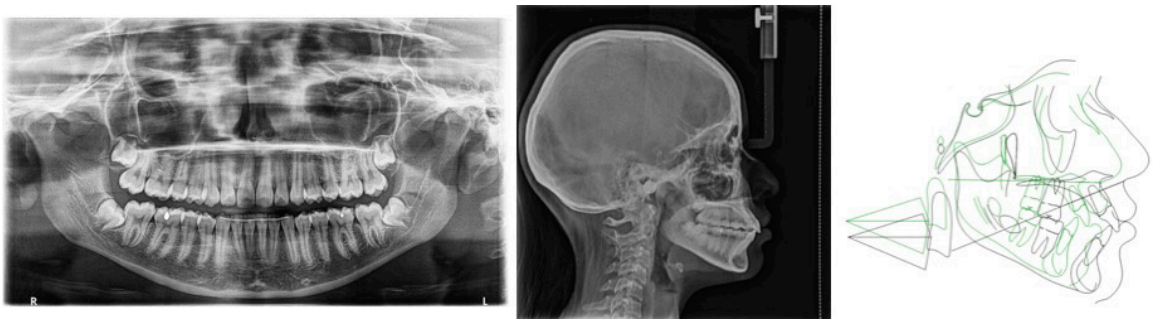

Figure 8. Final orthopantomography and lateral headfilm, and superimposition image.

DISCUSSION

Facial aesthetics can have a positive influence on interpersonal relationships and self-esteem[11]. According to Freitas *et al*.[12], the decision of treatment with or without extractions does not affect the facial profile, as long as it is based on an adequate diagnosis. In the present clinical case, the patient finished the treatment with a pleasant facial profile, with a nasolabial angle of 90°, as the norm states. Freitas *et al*. also suggest not to perform extractions in Class I patients with increased overbite and decreased anterior facial height, since retroinclination of the incisors could aggravate the deepening of the bite. In our case the patient had an overbite of 5 mm and decreased lower facial height (42° according to Ricketts), therefore, the choice of treatment was appropriate to the characteristics of the patient. The most important variables that favor the decision to perform extractions in class I patients are proclined upper and lower incisors. Our patient presented retroinclination of upper incisors and lower incisors according to Ricketts analysis, therefore, extractions were not considered necessary[13].

Nam *et al*.[14] demonstrated in a systematic review of dental and skeletal changes associated with the Damon® philosophy that patients treated with this system presented proclined lower incisors, contradicting the claim of the Damon® group that the low pressure of the Damon® archwire system and lip pressure at rest prevents the tendency of the incisors to procline, functioning as a lip bumper. The patient had lower incisors with normal inclination according to Ricketts (20°) so we did not find it inconvenient to select the Damon passive self-ligating system for the treatment. In the final results, we observed that the teeth proclined. However, they remained in their bony base (Figure 8).

In a study by Lineberger *et al*.[15] on the effects produced by a passive self-ligation system in which patients treated with passive self-ligation and an untreated control group were compared, it was observed that treatment with a passive self-ligation system can produce a satisfactory increase in the upper and lower dental arches. On the other hand, Herzog *et al*.[16] compared changes in arch width in Class I patients with and without extractions. A smaller arch width was found in treatments with extractions compared to those without extractions. A wide smile with narrow buccal corridors is aesthetically more pleasing and is related to arch form and changes in arch width after orthodontic treatment. In the present clinical case, the patient's arch was widened resulting in narrow buccal corridors when smiling, producing a very pleasing and esthetic smile.

Shook *et al*.[17] concluded in a study that there is no significant difference in buccal corridor width between patients treated with Damon® and conventional *bracket* systems.

CONCLUSIONS

Decision-making in the treatment plan for patients with Class I malocclusion should be made considering several characteristics, such as the patient's profile, the inclination of the incisors, and the lower facial height. In the present case, all the characteristics were suitable for a non-extraction treatment, which was confirmed by the obtained results.

BIBLIOGRAPHIC REFERENCES

1. Graber LW, Vandarsall RL, Vig KW, Huang GJ. *Ortodoncia, principios y técnicas actuales*. 6 ed. Barcelona: Elsevier, 2017.
2. Kiyak HA. Does orthodontic treatment affect patients' quality of life? *J Dent Educ*. 2008; 72(8): 886–894. PMID: 18676797
3. Angle, EH. Classification of malocclusion. *Dent Cosmos*. 1899; 41(18): 248-264. Citado en: Alhammadi MS, Halboub E, Fayed MS, Labib A, El-Saaidi C. Global distribution of malocclusion traits: A systematic review. *Dental Press J Orthod*. 2018; 23(6): 40.e1–e10. DOI: 10.1590/2177-6709.23.6.40.e1-10.onl
4. Proffit WR, Fields HW, Larson BE, Sarver DM. *Ortodoncia contemporánea*. 5 ed. Barcelona: Mosby, an imprint of Elsevier, 2013.
5. Proffit WR, Fields HW, Larson BE, Sarver DM. *Ortodoncia contemporánea*. 6 ed. Barcelona: Elsevier, 2019.
6. Melgaço CA, Araújo MTS. Asymmetric extractions in orthodontics. *Dental Press J Orthod*. 2012; 17(2): 151–156. DOI: 10.1590/S2176-94512012000200025
7. Murphy CC, Magness WB, English JD, Frazier-Bowers SA, Salas AM. A longitudinal study of incremental expansion using a mandibular lip bumper. *Angle Orthod*. 2003; 73(4): 396–400. DOI: 10.1043/0003-3219(2003)073<0396:ALSOIE>2.0.CO;2
8. Longlax-Triana MC, Jaimes Monroy G, Boada-Cuesta NJ, Lugo-Latorre AM. Efectividad de la expansión maxilar en la corrección de apiñamiento en dentición mixta. Revisión sistemática. *Int J Odontostomat*. 2020; 14(1): 101-106. DOI: 10.4067/S0718-381X2020000100101
9. Birnie D. The Damon passive self-ligating appliance system. *Semin Orthod*. 2008; 14(1): 19-35. DOI: 10.1053/j.sodo.2007.12.003
10. Meeran NA. Self-ligating brackets: an update. *J Clin Orthod*. 2012; 46(4): 235-241. PMID: 22785015
11. Claudino D, Traebert J. Malocclusion, dental aesthetic self-perception and quality of life in a 18 to 21 year-old population: a cross section study. *BMC Oral Health*. 2013; 13: 3. DOI: 10.1186/1472-6831-13-3
12. Freitas BV, Rodrigues VP, Rodrigues MF, de Melo HVF, Dos Santos PCF. Soft tissue facial profile changes after orthodontic treatment with or without tooth extractions in Class I malocclusion patients : A comparative study. *J Oral Biol Craniofac Res*. 2019; 9(2): 172-176. DOI: 10.1016/j.jobcr.2018.07.003
13. Ali B, Shaikh A, Fida M. Factors affecting treatment decisions for Class I malocclusions. *Am J Orthod Dentofacial Orthop*. 2018; 154(2): 234-237. DOI: 10.1016/j.ajodo.2017.11.035
14. Nam HJ, Flores-Mir C, Major PW, Heo G, Kim J, Lagravère MO. Dental and skeletal changes associated with the Damon system philosophical approach. *Int Orthod*. 2019; 17(4): 621-633. DOI: 10.1016/j.ortho.2019.08.001
15. Lineberger MB, Franchi L, Cevidanes LHS, Huanca Ghislanzoni LT, McNamara JA. Three-dimensional digital cast analysis of the effects produced by a passive self- ligating system. Eur J Orthod. 2016; 38(6): 609-614. DOI: 10.1093/ejo/cjv089

16. Herzog C, Konstantonis D, Konstantoni N, Eliades T. Arch-width changes in extraction vs nonextraction treatments in matched Class I borderline malocclusions. Am J Orthod Dentofacial Orthop. 2017; 151(4): 735-743. DOI: 10.1016/j.ajodo.2016.10.021
17. Shook C, Kim SM, Burnheimer J. Maxillary arch width and buccal corridor changes with Damon and conventional brackets : A retrospective analysis. Angle Orthod. 2016; 86(4): 655-60. DOI: 10.2319/050515-304.1