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# Evaluation of the Therapeutic Efficacy of Functional Devices of Planas: Longitudinal Study of a Population of Young Children Aged 7 to 9 Years, Presenting Incisor Crowding Associated with Skeletal Class I or Class II

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## ABSTRACT

***Objects**: Evaluate at the beginning of mixed dentition, the effect of planas plates tracks on disharmony between tooth and jaw size and transverse dimensions of maxillae, on mandibular retrognathia and mandibular growth direction, and on masticatory function.*

***Material and Methods**: The study was carried out on a population of 82 school children, aged 7 to 9 years, from the city of Blida, presenting incisor crowding on a skeletal class I or class II. They were divided, by drawing lots, into two comparable groups: a control group and a group having received treatment with track plates associated with selective grinding. Measurements on mouldings, on photos and on face and profile teleradiographies, were performed on each patient before and after one year of follow-up.*

***Results:** A significant difference was noted between the two groups concerning the dento-alveolar and masticatory parameters. For the skeletal parameters, the difference is not statistically significant between the two samples.*
***Conclusion**: The results confirm the effectiveness of the Planas appliance in the treatment of dento-maxillary disharmony, by expansion and plead in favor of an early treatment, in mixed dentition of this malocclusion. They also show the restoration of chewing function. With regard to the shift of the skeletal bases, if the clinical observations showed its reduction, the measurements did not demonstrate it, due to an excessively small sample size.*

## Keywords
Dento-maxillary disharmony, Expansion, Planas plates tracks, Fonction of mastication.

## Introduction
Three processes create space on a crowded dental arch: tooth extraction, "stripping", expansion.

The first two were practiced from the dawn of orthodontics [1] (1728). The expansion was found later (in 1841) by Le foulon [2] who, having discovered the possibilities of expansion, opposed extractions in cases of dental crowding.

The expansion experienced a period of absolute domination (1911-1950) (Angle in the United States, Pont in France [3,4]), then was doomed in the middle of the 20th century [5,6].

Only in Europe, the functionalists, who think they can increase the size of the maxillary arches, oppose extractions. Planas is one of those who offer physiological expansion techniques to solve problems of dento-maxillary disharmony (characterized by a negative difference between the space available on the dental arch and the space necessary for alignment teeth) [7]. He develops a functional device; track plates.

If we choose to treat our patients using Planas track plates, will we be able to accommodate all the teeth without extracting them?

Planas offers us his interceptive, conservative treatment of dento-maxillary disharmony (DMD); these clinical observations have amply demonstrated this. The track plates would have an expansion possibility of 11 mm. A second important reason for extractions for orthodontic treatment exists [8]. It consists of class II (skeletal shift of the maxillary bases in the direction of mandibular retrognathia). Wearing the Planas device, in the case of associated skeletal class II, leads to the correction of mandibular retrognathia by a simple change of orientation of the tracks. This inclination makes it possible to obtain a smaller vertical dimension of occlusion when the patient approaches the class I position. Finally, Planas affirms that its device allows the functional correction of mastication [7,9,10]. Is this true? Knowing that alternating unilateral mastication is the one that allows the most harmonious development of the maxillae, it is preferable to treat this function as soon as possible so that the cranio-facial structures adapt to now physiological mastication, thus catching up of growth thanks to the time they have, this on the one hand. On the other hand, restoring physiological mastication ensures the sustainability of the treatment undertaken. Very few quantified data on treatment with track devices are reported in the literature to scientifically confirm the clinical results observed for several years by many practitioners.

This study is proposed to evaluate and quantify the therapeutic effects of the Planas apparatus on dento-maxillary disharmony, mandibular retrognathia and masticatory function.

## Materials and Methods

We carried out a longitudinal, comparative and randomized study to evaluate the influence of track plates on DMD and the transverse dimensions of the jaws. The study concerned a population of 82 schoolchildren, aged 7 to 9, in the city of Blida, Algeria. These children are in mixed dentition: an ideal period for any interceptive therapy.

For the sample size, taking a risk of error of 0.05 and a power of 95%, the number of subjects required was estimated at 37 children for each group, i.e. a total of 74 children. We recruited 84 patients, which represents a 13% increase in staff. However, after drawing lots, we lost sight of two patients, which gives a sample size of 82 patients.

To avoid a source of bias linked to a non-comparative evaluation, we have formed two comparable groups:

- A group of patients (group A) receiving treatment with track plates, associated with (or preceded by) selective grinding, with a one-year follow-up;
- The second group (group B) is the control group, which allows us to compare our results with the natural evolution of the jaws, over time (12 months).

The method used for drawing lots is the block method [11]: it ensures the random allocation of treatment from a permutation table. This process resulted in 42 subjects in each group. We included in our study, children presenting a DMD associated with a skeletal class I or class II with mandibular responsibility (ANB angle greater than 4°), aged 7 to 9 years, without distinction of sex.

We did not include children who had been treated previously, children with malformation syndromes and children with psychomotor disabilities.

During our work, we set out to study the effect of track plates on:

- The anterior DMD and the transverse dimensions of the jaws;
- Mandibular retrognathia, skeletal class II as well as the direction of mandibular growth;
- The chewing function.

A complete orthodontic assessment was established for each patient. The informed consents duly signed by the legal guardians were retrieved. The study lasted 21 months. All patients were treated by the same practitioner and using the same technique.

The orthodontic appliances used are Planas track plates [10,12,13]. These are functional appliances directly inspired by the physiology of mastication. They consist of two resin plates, one maxillary and the other mandibular. Each plate includes stabilizing hooks, an expansion screw, and horizontal resin tracks, which are located on the inner side of the teeth.

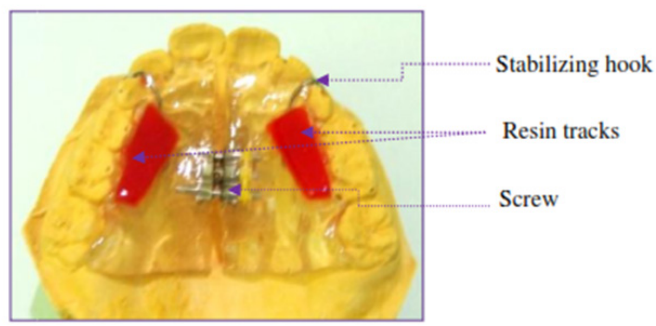



**Figure 1:** Upper track plate.

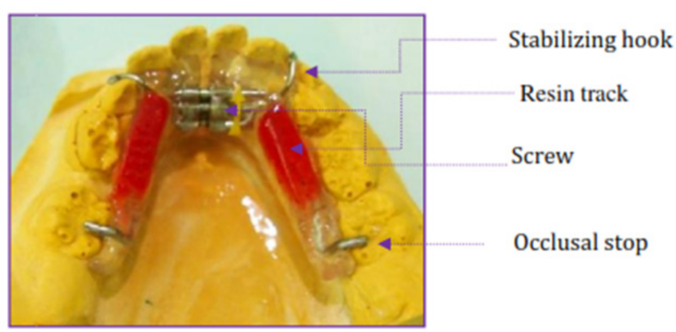



**Figure 2:** Lower track plate.

The tracks are presented as flat resin surfaces; they are built parallel to Camper's plane (Figure 3a). However, an inclination of the tracks was made in cases of mandibular retrognathia 10.

Tracks were constructed obliquely upwards in the postero-anterior direction (Figure 3b), so that when the patient closes the mouth in its usual position, it is impossible to find the pathological centric occlusion by increasing the vertical dimension. The patient then seeks a smaller vertical dimension, which leads him to move the mandible forward.

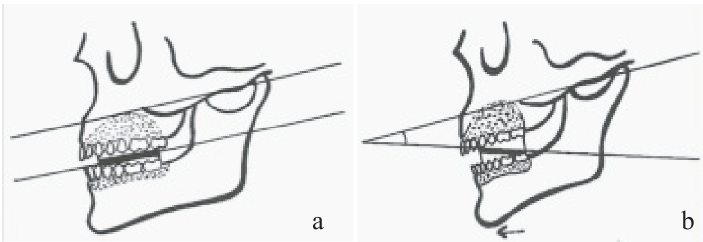



**Figure 3:** Orientation of the tracks of Planas [10]: a. tracks parallel to the plane of Camper; b. tracks oblique upwards in the postero-anterior direction.

After placing the casts in the articulator (semi-adjustable articulator), the palatal and mandibular plates in self-polymerizing acrylic resin were made and polymerized under pressure. These devices were made by the same prosthetist, trained in neuro-occlusal rehabilitation. The articulator used in our study, which simulates at will the movements that the patient can produce, allowed a first adjustment of the tracks of Planas in propulsion and laterality. A second adjustment, which is more precise, was then carried out in the clinic when the device was delivered.

The device was worn at all times, 24 hours a day, throughout the treatment. However, patients have been advised to remove it during meals in order to «recharge the batteries» [10] so that the child regains the physiological stimulation of chewing. The screws were opened at a rate of a quarter turn per week, which is equivalent to 0.25 mm. For a better efficiency of the device, we have worn down the teeth by selective grinding, so that during meals a physiological, unilateral alternating mastication can take place and prolong the stimulation of growth.

Selective grinding allows us to artificially achieve the physiological abrasion that would occur if the food were «hard and dry», thus freeing the mandibular laterality movements.

With regard to the measurements and measuring instruments used in our study, we performed measurements on plaster models (obtained from impressions made on the patients) and on frontal teleradiography. These measurements are in millimeters and made using a digital vernier caliper. Linear values on lateral teleradiography also benefited from the same measuring instrument. The method error is calculated by Dahlberg's formula [14]. For the cephalometric analyses, a protractor, a setsquare, tracing paper and a pencil were used for the measurements on lateral teleradiographies.

To study mastication, we used the FMAP variable (functional masticatory angle of Planas). They were recorded on photos and then measured using a protractor. The different variables used in our study, on casts and frontal and profile teleradiographies, performed by the same operator, were taken at two different times:
- Before treatment: time T0.
- After one year of follow-up: time T1.

The time T0 corresponds to the first assessment carried out in the treated group and the control group.
Time T1 corresponds to the follow-up assessment with or without treatment with Planas track plates.
The variables used in our study are:
- Maxillary and mandibular anterior crowding which is the difference between the space available and the space necessary for the optimal eruption of the 4 permanent incisors [15].
- The intercanine distance, which is the distance, measured between the top of the cusp of the right lacteal canine to the top of the cusp of the left lacteal canine in the maxilla and mandible [15].
- The intermolar distance, which is measured from the central fossa of the right first permanent molar to the central fossa of the left first permanent molar in the maxilla and mandible [16].
- The inter-collar distance is the rectilinear transverse dimension measured from the collar, at the level of the palatal or lingual sulcus, of the right first permanent molar to the palatal or lingual collar of the left first permanent molar, to the maxilla and to the mandible [17,18].
- The maxillary width measured on frontal teleradiography, between the jugal points. The jugal point is the most concave point of the right and left maxillary tuberosities [19].
- The bi-antegoniac distance is measured between the two-antegonial points [16].
- The SNA angle and the SNB angle [19,20]: these two angles measure the relative position of the maxilla and the mandible in relation to the base of the skull.
- The angle ANB [19,20]: is the arithmetic difference between SNB angle and SNA angle. The ANB angle signs the offset of the maxillary bases.
- Co-pog [17,21]: the mandibular length is defined between the condylion point (top of the condyle) and the pogonion point (most anterior point of the symphyseal cortex).
- The FMAP: is the angle formed, in the frontal plane, by the horizontal and the line, more or less oblique, materializing the displacement of the lower inter-incisal point during a mandibular laterality movement (the starting point being the maximum intercuspation). The difference between right and left AFMP is our judgment criterion, and it is this difference that we sought to reduce or eliminate during our treatment in order to achieve alternating unilateral chewing [21,22].

For the statistical methodology, we used:
- for data entry the Epi Data 3.1 software, for database control the Epi Info 6.04 software;
- for statistical analysis, the Stata 9.2 software (Stata Corp 4905 Lakeway Drive College Station, Texas 77845 USA).

The results were expressed as means and standard deviations for the quantitative variables at each observation time and as a percentage and frequency for the qualitative variables.
For the comparison of the means, we used the Z score test.
For the comparison of percentages, the tests used are:

- the Khi square test when the calculated number was greater than or equal to 5;
- Fisher's exact test when the calculated number was less than 5.

The results were considered significant at the 5% level of uncertainty ($p < 0.05$).

## Results

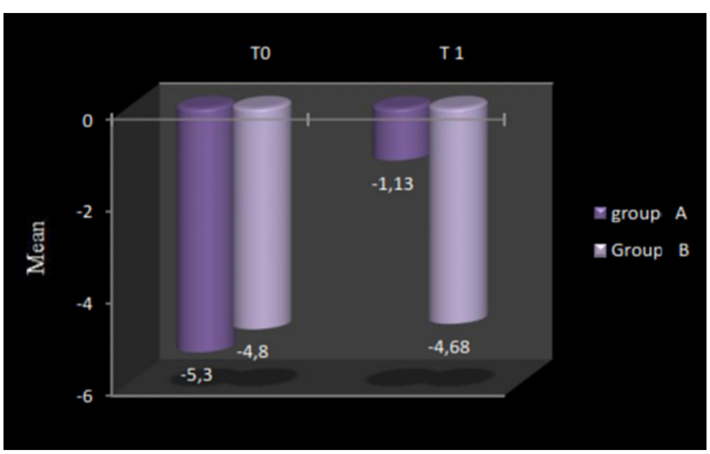
The age at the beginning of the study varies between 7 years and 9 years and 7 months. The average at the start of the study is 8 years. The average age at the end of the study is 9 years old.

The population selected for this study includes 57 girls (69.51%) and 25 boys (30.49%). The distribution by sex in the two groups does not show any significant difference (p=0.81). The study of the action of the Planas device made it possible to find the following results:

- Between time T0 and T1, maxillary and mandibular dental crowding decreases significantly ($p < 10^{-3}$), in patients treated with track plates. On the other hand, the control group does not show the same evolution.

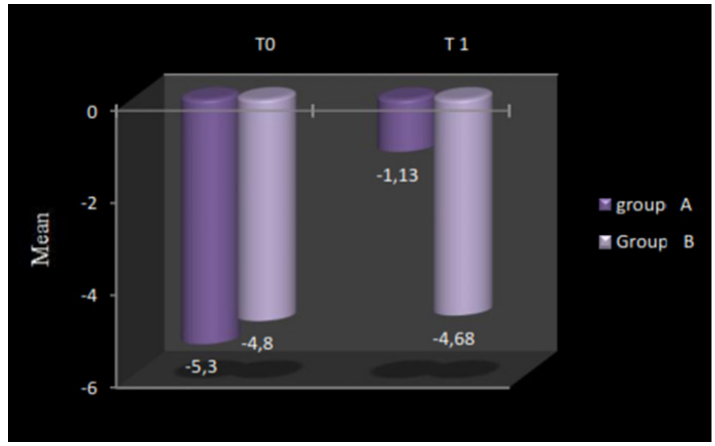
| Maxillary dental crowding (Group A) | | | | | | Maxillary dental crowding (Group B) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Times | N | S | Mean | Min | Max | Times | N | S | Mean | Min | Max |
| $T_0$ | 41 | 2,29 | -5,74 | -10,57 | -2,1 | $T_0$ | 41 | 2,28 | -5,33 | -11,15 | -1,2 |
| $T_1$ | 41 | 1,68 | -1,13 | -4,50 | 1,2 | $T_1$ | 41 | 2,25 | -5,19 | -11,30 | -0,9 |

**Table 1:** Measurement of maxillary dental crowding in groups A and B; N: study population; S: standard deviation; Mean: average of the statistical series; Min: minimum value of the statistical series; Max: maximum value of the statistical series.



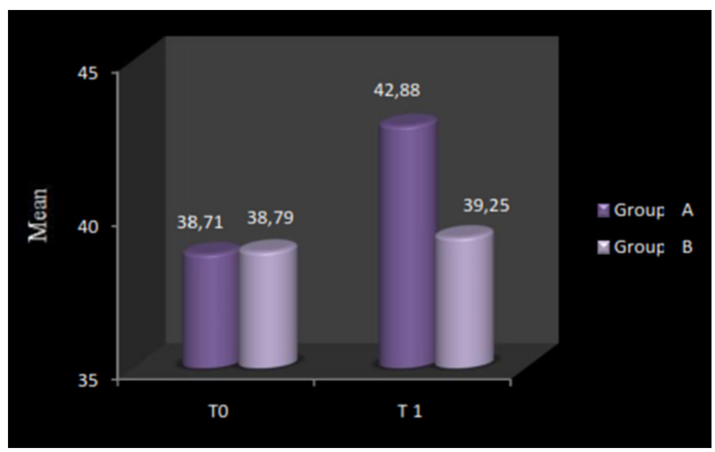

**Graph 1:** Evolution of mandibular dental crowding over time in groups A and B.

For the intercanine distance, it changes significantly in the treated cases, compared to the control group. The intercanine distance increases significantly ($p < 10^{-3}$) between time T0 and T1, it is 4.78 mm at the mandible and varies between 4.5 and 6.29 mm at the maxilla (graph 2). On the other hand, the control group shows a very weak evolution (average of 0.49 mm in the maxilla, 0.53 mm in the mandible), over time.



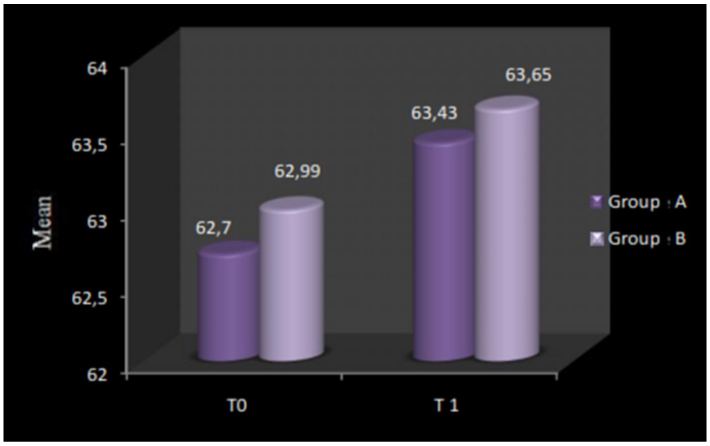

**Graph 2:** Evolution of the maxillary intercanine distance in groups A and B.

Concerning the intermolar distance, a highly significant variation ($p < 10^{-3}$) is noted over time in the treated group (on average 4.64 mm in the maxilla and 4.17 mm in the mandible). In the control group, we observe an evolution of 0.49 mm in the maxilla and 0.46 in the lower arch. This is very low compared to the treated group.




**Graph 3:** Evolution of the mandibular intermolar distance in groups A and B.

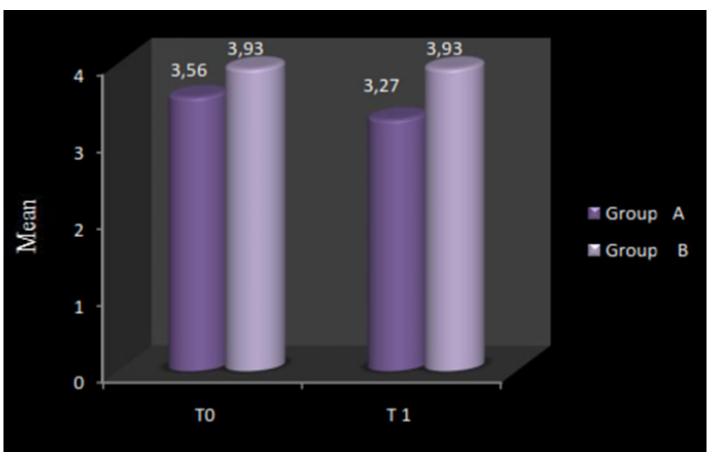
At time T1, the inter-collar distance shows a significant difference between the two groups. We observe a small variation (0.37 mm at the top, 0.31 mm at the bottom) between the start and the end of the study in the control group, while we note a greater change in the treated group ($p < 10^{-3}$). Indeed, an increase of around 3.94 mm in the maxilla and 3.34 mm in the mandible can be observed between T0 and T1. For maxillary and mandibular width, it changes slightly over time and shows no significant difference (p= 0.80) between the two groups of patients at time T1.




**Graph 4:** Evolution of maxillary width in groups A and B.

With regard to the mandibular length, a significant change over time is observed (p = 0.0003). However, comparing the two groups, we note a non-significant difference between the two (p = 0.11).

At time T1, the patients present the same values at the level of the SNA angle. No change was observed from T0 to T1 in the two groups of patients (p = 0.53). On the other hand, there is a significant change (p = 0.009) over time in the SNB angle. Nevertheless, the difference is not significant (p = 0.69) between the two groups of patients at time T1. For the ANB angle, there is a very significant change (p = 0.001) over time. The comparison of the two groups of patients, at time T1, shows a significant difference (p = 0.04).




**Graph 5:** Evolution of ANB angle in groups A and B.

No modification of the FMA angle was observed over time in the two groups.

For the FMAP, the comparison of the percentages shows a significant change over time ($p < 10^{-3}$) in the treated group. No change was observed in the control group at T1 except for one patient. The difference between the two groups is very significant ($p < 10^{-3}$).

| FMAP | Time $T_0$ | | | | Time $T_1$ | | | |
|---|---|---|---|---|---|---|---|---|
| | Group A | | Group B | | Group A | | Group B | |
| | n | % | n | % | n | % | n | % |
| 0 | 0 | 0,00 | 0 | 0,00 | 33 | 80,49 | 1 | 2,44 |
| 1 | 0 | 0,00 | 0 | 0,00 | 8 | 19,51 | 0 | 0,00 |
| 2 | 19 | 46,34 | 19 | 46,34 | 0 | 0,00 | 19 | 46,34 |
| 3 | 22 | 53,66 | 22 | 53,66 | 0 | 0,00 | 21 | 51,22 |
| Total | 41 | 100 | 41 | 100 | 41 | 100 | 41 | 100 |

**Table 2:** Evolution of FMAP in groups A and B; 0: equal FMAP: alternating unilateral mastication; 1: AFMP almost equal; 2: AFMP unequal, smaller on the right: preferential mastication on the right; 3: AFMP unequal, smaller on the left: preferential chewing on the left.

## Discussion

The interest of this study is to observe the effects of Pedro Planas' track devices. Various parameters were observed; the evolution of these makes it possible to study the action of the device on the jaws. To avoid a source of bias linked to a non-comparative evaluation, we formed by drawing lots(block method) [11] two comparable groups: a group to receive the treatment with planas tracks and a control group allowing us to compare our results to the natural evolution of dental arches over time (one year).

For the International Bioethics Committee, every human person has the right to treatment. In our study, this problem was solved by treating all patients in the control group, after the second assessment (T1), with the free and informed consent of the participants. These patients are still old enough to receive interceptive treatment.

In our study, the girls/boys distribution is relatively homogeneous in the two groups even if the number of girls (69.51%) in the overall sample is greater than that of boys (30.49%). If we compare this prevalence with the study by Del Aguila [23] carried out in 1998 (N=203), 55.7% of girls and 44.3% of boys make up the sample, we note a higher prevalence of subjects female. The same result was found in Marie Leroux's study [17] (50.5% girls and 49.5% boys). The study by Keski-Nisula and Varella [24] evaluating the prevalence of anterior crowding in young children also shows a higher prevalence of anterior crowding in girls. The aim of our research was to observe the effect of this device in young children. The **age** at the beginning of the study varies between 7 years - 9 years and 7 months. The average age of the subjects is 8 years old at the first assessment before the installation of the device (time T0), 9 years at the time of the second assessment (time T1), end of the observation period. The age distribution of the subjects is relatively homogeneous at each time. The works carried out by Carlos de Salvador Planas [25] (grandson of Pedro Planas), Del Aguila [23] and Leroux [17] start from a much more heterogeneous database at T0. Indeed, there is no homogeneity in the age of patients at the start of treatment. This varies from 3 to 14 years for the study by C. Planas, from 4 and 14 years for that of Del Aguila and from 3.5 to 8.7 years for the study by Leroux.

If the observation deadline is very homogeneous in our study (one year) for the two groups, it is very heterogeneous in the study of C. Planas 25 (varying from 11 to 78 months) and that of M. Leroux

17 which includes extremes ranging from 2 months to 57 months. This lack of consistency in treatment observation times stems from the existing database, which is retrospective.

The study of the action of the Planas apparatus has made it possible to analyze the evolution of the dento-maxillary disharmony of the subjects over time.

The **upper crowding** parameter shows greater dento-maxillary disharmony in the upper arch than in the lower arch, in both groups. The subjects of the Del Aguila study also present a higher crowding in the maxillary arch. In 2008, Lux [16] observed, in a population of 9-year-old children, more frequent severe anterior crowding (> 5 mm) in the maxilla. The clinical observation of the treated group (group A) shows that the Planas appliance corrects anterior dento-maxillary disharmonies thanks to an expansion of the maxillary and mandibular arches. The correction of the upper crowding progresses on average from -5.75 mm at time T0 to -1.128 mm at time T1 and justifies our clinical observations.

The correction of the lower dental crowding evolves from -5.30 mm at time T0 to -1.127 mm at time T1. The observation of the control group, which did not benefit from the treatment with track plates, shows an almost non-existent improvement in DMD over time.

In her study, Marie Leroux 17 also showed the effectiveness of the Planas appliance in the correction of upper and lower dental crowding. The DMD went from - 5 mm at time T0 to + 0.95 mm at time T1 in the maxilla and from - 3.75 mm at T0 to + 0.81 at T1 in the mandible.

The study of the expansion of the arches involves the analysis of the transverse dimension at the inter-canine and intermolar level. For the **intercanine distance**, we were able to observe a significant evolution from time T0 to time T1. The study presented shows an increase in the intercanine distance between 4.5 mm and 6.29 mm at the upper arch and between 4.01 mm and 4.95 mm at the lower arch between time T0 and time T1. These measures relate to the treated group. For the control group, we have an increase in the intercanine distance, which varies between 0.27 mm and 0.8 mm in the maxilla and 0.22 mm and 0.53 mm in the mandible. Del Aguila demonstrated a natural increase in the maxillary and mandibular intercanine distance in the control group, which varies between 0 and 2 mm from time T0 to time T1 and for the treated group an increase of 3 to 6 mm.

In his study of 42 patients with Planas appliances, Carlos Planas shows an average expansion of 6 mm and 4.45 mm greater in the mandible from time T0 to time T1. Marie Leroux, found an average expansion of 5 mm in the maxilla and 5.5 mm in the mandible from time T0 to time T1. As for the **intermolar distance**, we observed in the control group a natural increase in the intermolar distance of 0.49 mm in the maxilla and 0.46 in the mandible from time T0 to time T1.

In the treated group, we found that the Planas apparatus causes an increase in the intermolar distance of an average of 4.64 mm in the maxilla and 4.07 mm in the mandible from time T0 to time T1, Marie Leroux, in her study, found an average expansion of 5.72 in the maxilla and 4.81 mm in the mandible. Carlos Salvador Planas observed greater expansion values: 7.76 mm in the maxilla and 6.43 mm in the mandible.

The use of **the inter-collar distance** in this study aims to compare its evolution over time with that of the intermolar distance. This allowed us to analyze whether or not this type of expansion leads to a version of the teeth.

Version phenomena are present in our study. This observation contradicts the thesis of C. Planas who, by using Chateau's goniometry, does not observe any dental version. Del Aguila, Mr. Leroux as for them, observe a dental version.

The use of Chateau's goniometry [26] would perhaps make it possible to better judge the phenomena of versions.

In 2004, Christine Frankenne [27] compared maxillary transverse expansion by Planas apparatus and Schwartz apparatus using the dental scanner. The radiological images showed that the vestibular cortices thinned in the group treated with the Schwartz plate compared to the Planas group. A greater tilting movement of the teeth can explain this, whereas in the Planas group these images were not observed. We can therefore conclude that the Planas appliance leads to transverse expansion with less tooth version. Further observations were made regarding the effects of the device on various skeletal parameters. The **bi-antegoniac distance** and the maxillary width from time T0 to time T1 confirm the results of those of Del Aguila. No effect compared to the natural growth values of the control group is demonstrated. The Planas apparatus therefore has a dento-alveolar effect.

On the other hand, Marie Leroux found that the maxillary width is on average a little higher at time T1 than the normal growth values found in the literature. She explains these slightly higher values by the presence of the mid-palatal suture at the maxillary level, which can be stimulated by the device. At the start of the study, the **mandibular length** is lower in class II patients compared to class I subjects. However, we were able to observe that this length changes more significantly in class II/group A subjects (mean of 3.56 mm) than in class I/group A subjects (mean of 1.5 mm) from time T0 to time T1. Moreover, this increase is only 0.97 mm in class II/group B. Even if the difference is not significant between the two groups in class II ($p = 0.17$), we were able to observe clinically that the therapy (plates with inclination of the tracks of Planas from front to back and from top to bottom) had a beneficial effect on the mandibular growth of class II by "unlocking" it and allowing it to catch up part of the lag between of the maxillary and mandibular skeletal bases. A larger sample size of class II cases might have given more convincing results.

For the **SNA angle**, we did not observe any variation in this angle during our study, whether for class I or for class II. The mean value of the **ANB angle** shows that 70 subjects present a skeletal class I and 12 present a skeletal class II. Before treatment, the value of this angle is higher in class II patients, which seems logical. During the treatment, the ANB will decrease in class II/group A (by 1.17°) due to the therapy, whereas in the control group, we observe no change. The difference between the two groups is significant (p=0.02).

Regarding the **SNB angle**, we do not notice, after treatment, any change in patients with class I. On the other hand, in class II, if we do not see any change in the control group, it is not the same for the treated group where we have an increase of 1.17°. But the difference is not statistically significant. We note that for class II cases, at time T1, the difference is statistically significant between the two groups only for ANB. While for the SNB angle and the mandibular length, Co-Pog the difference is not significant. A larger sample size for class II cases would, perhaps, give clearer results.

The **FMA** presents relatively stable values throughout our study, in all patients. What is unusual; class II therapies generally lead to an increase in the FMA and the lower level of the face. For Pedro Planas [10], the treatment in RNO (track plates and selective grinding), allows the restoration of a functional anterior guide, a reorientation of the occlusal plane and the resultant of the chewing forces projecting the mandible forward. This could possibly explain the stability of the FMA angle after class II therapy.

*Occlusal imbalance* is the major cause of treatment failure for Pedro Planas. He considers that it is the restoration of mandibular laterality movements, which is the main condition for post-orthodontic stability, itself conditioned by obtaining a balanced occlusion 8, 9. We have therefore ensured, along with the expansion, adjust lateral movements and balance FMAP.

The evolution of FMAP, in the different subjects, was observed during our study. At time T0, all the patients had right or left dominant (even exclusive in some cases) mastication. No patients had symmetrical FMAP.

At time T1, we were able to observe an equality of FMAP in 80.49% of cases, in the treated group. In the control group, only one patient showed equality of FMAP at time T1. This is probably related to the dental caries treatment he received.

After treatment by track plate, we were able to observe that 8 patients retained unequal FMAP (even if the difference between the two angles was less significant than at time T0). The persistence of an asymmetry of the FMAP is explained by the fact that the permanent teeth required significant selective grinding but as they do not occupy their definitive place (mixed dentition) and that the occlusal relationships will be modified, we preferred to do discreet grinding and follow up the patient until the eruption of permanent teeth.

In his study Carlos De Salvador Planas [25], found a persistence of FMAP asymmetry after treatment in 17% of cases (patients not coming to the mandatory biannual check-ups).

## Conclusion and Perspectives

Based on the observation that little research on treatments with Planas track devices is reported in the literature, our study consisted of a collection and analysis of the effects of the Planas device in the short term.

Different observations obtained based on multiple measurements, carried out on plaster models and teleradiographies, have enabled us to analyze and quantify the evolution of the effect of this device on a large number of dental and skeletal parameters.

Most of these measurements confirm in figures the clinical results observed for several years by planassians:

- The expansion of the maxillary and mandibular arches is confirmed in this study;
- Restoration of the masticatory function: the treatment plan carried out gave the patients the possibility of carrying out physiological mandibular laterality movements essential for good orthopedic therapy;
- Reduction the lag of the skeletal bases by promoting mandibular growth.

However, the reduced sample size of skeletal class II cases (6 cases in each group of our study) does not allow us to conclude with certainty that Planas appliances constitute a true orthopedic prophylaxis in cases of mandibular retrognathia.

At present, the pendulum of evolution has definitively swung back towards treatments without extractions [28] and orthodontists practicing early treatment have understood that it is better to treat the cause of orthodontic disorders, as soon as possible, rather than to having to squander the dental capital of the subjects once growth is complete. The resulting normalization will help the future harmonious development of the masticatory apparatus and the eruption of permanent teeth.

This study therefore justifies the importance of performing early interceptive treatment in the case of dento-maxillary disharmony associated with skeletal class I or class II.

We have seen above that the sample size of class II cases, in the population studied, was too small to assert with certainty the effectiveness of track plates in the treatment of mandibular retrognathia, so it would be very interesting to analyze the effects of these devices on a sample size more adapted for this objective.

As regards the effect of the Planas device in the long term, it would be appropriate to spread this study over several years by standardizing the periods between the different check-ups, thus following the complete treatment of a certain number of patients. Such a study would make it possible to analyze post-orthodontic stability.

The large database collected could also be used to make comparisons with different transverse expansion devices. This study is therefore a trial to demonstrate the effectiveness of the Planas track device in the early treatment of anterior dento-maxillary disharmony, by expansion.

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