Assessment of tooth inclination in the compensatory treatment of pattern II using computed tomography

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Abstract

Objective: To evaluate changes in the inclination of anterior teeth caused by orthodontic treatment using a Straight-Wire appliance (Capelozza's prescription II), before and after the leveling phase with rectangular stainless steel archwires. **Methods:** Seventeen adult subjects were selected who presented with facial pattern II, Class II malocclusion, referred for compensatory orthodontic treatment. Inclinations of anterior teeth were clinically assessed using CT scans at three different times, i.e., after the use of 0.020-in (T1), 0.019 X 0.025-in (T2) and 0.021 X 0.025-in (T3) archwires. Friedman's analysis of variance was applied with 5% significance level to compare the three assessments (T1, T2 and T3). **Results:** It was noted that the rectangular wires were unable to produce any significant changes in inclination medians, except for a slight change in mandibular lateral incisors (p<0.05). On the other hand, variations in inclination were smaller when 0.021 X 0.025-in archwires were employed, particularly in maxillary incisors (P<0.001). **Conclusion:** The use of rectangular 0.021 X 0.025-in archwires produces more homogeneous variations in the inclination of maxillary incisors, but no significant median changes.

Keywords: Computed Tomography. Orthodontic treatment. Tooth inclination.

INTRODUCTION

The aim of the Straight-Wire technique is to ensure that teeth are optimally positioned by the end of treatment while reducing the need for bending orthodontic archwires. Since its inception, several authors have suggested changes to the original prescription values.[5] These changes yielded new, unique prescriptions in the search for one that would fit all or most cases.

In the following years—before this technique became the most widely used worldwide—several authors claimed that most orthodontists had embraced this technique because they did not use larger-caliber archwires to finish their cases.[12,13] Nonetheless, discussions were already under way about the need for adjustments to compensate for the slack between archwire and bracket slot, even when thicker archwires were

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used, in order to move teeth to their planned position. Thus, when evaluating an orthodontic appliance, one should not just consider its prescription but also the archwire progression protocol being employed. Moreover, professionals need to tailor the orthodontic treatment for each patient individually if satisfactory aesthetic and functional outcome are to be achieved.[11]

After assessing the inclinations of teeth of treated and untreated groups who had normal occlusion, Vardimon and Lambertz[29] noted a standard deviation of ± 5°, indicating a considerable dispersion of inclination means in all teeth. There was no statistically significant difference between the two groups, except in the second mandibular molar. In contrast with the original Straight-Wire prescription, this study showed different values for maxillary incisors, +1° for central incisors and -1° for lateral incisors.

Any ideal preadjusted appliance featuring identical torques and angulations for all patients seems to be unacceptable. This conclusion was confirmed after examining the buccal surface of the teeth, determining the extent and frequency of changes in their contour and assessing inclination when brackets were bonded more incisally or gingivally on their buccal axis.[13] As the more posterior teeth were examined, wider variations were noted on their buccal surface both in the maxilla and mandible, however, all the teeth of the same individual presented homogeneous variation.

In a comparison between the inclination of anterior teeth in cases treated with fixed edgewise, Straight-Wire, Roth prescription appliances and normal occlusion cases, the upper anterior teeth of the latter individuals exhibited negative values, whereas the former displayed positive, or buccal inclinations.[28] Inclinations found in subjects treated with MBT™ prescription were statistically different when compared with the "Six Keys to Normal Occlusion".[5] Significant individual variations were also observed.[6] When Brazilians with

normal occlusion were compared with the original Straight-Wire[5] values, the inclinations of the vast majority were negative, with the sole exception of the maxillary incisors.[30]

For compensatory treatment of patients with facial patterns whose basal bones present with acceptable discrepancies, attention is paid to the position that the teeth should occupy by the end of treatment. The focus point is the direction of the dental compensation based on malocclusion features, treatment goal and treatment prognosis.[5,8] Three sets of prescriptions have been described,[8] one geared to the treatment of cases with normal maxillomandibular relationship (pattern I), and two other prescriptions aimed at cases of maxillomandibular discrepancies (pattern II or III), where the anterior teeth require compensatory torque and angulation to achieve an optimal occlusion, despite the skeletal condition.

Dental compensation of maxillary and mandibular incisors related to the anteroposterior relationship of the basal bones was evaluated in young Brazilians treated with standard Straight-Wire appliances, with orthodontic treatment without extractions and cases finished according to the Six Keys of Occlusion Normal.[5] The values found for the upper incisors were close to Andrews' sample (+7.96° to +7°, respectively), but highly discrepant in mandibular incisors (+5.03° to -1°). Moreover, it was observed that as the basal bones extend positively (maxilla ahead of the mandible) maxillary incisors vary their inclinations lingually while mandibular incisors vary their inclinations buccally, suggesting that orthodontic treatment could be performed with fewer extractions since it allows a significant buccoversion of mandibular incisors.[7]

The use of prescriptions built into the brackets and their proper utilization in treatment individualization are compromised as these preadjustments are not fully expressed due to the slack between bracket slot and archwire. This is

especially limiting in terms of inclination, when archwire progression stops before maximum caliber archwires are inserted, thereby preventing the features of a particular prescription from being fully expressed.

For this reason, it seems important to assess whether inclinations produced in the anterior teeth during the final stages of orthodontic leveling reflect the prescription values described by the bracket manufacturer.

Thanks to advances in dental imagining technology, more accurate diagnoses are now possible that boast a high degree of reliability while providing detailed images of structures in three-dimensional tests with less radiation exposure.[21,26,27] Computed tomography (CT) allows the reconstruction and visualization of anatomical areas in three dimensions, revealing information about size, shape and texture and has become an important tool for all areas of dentistry, providing reliable linear[15,18,20,23] and angular[22,23] measurements.

A method for evaluating torques and angulations by means of computed tomography has been described,[10] which faithfully depicts dental structures and allows professionals to measure each individual tooth, in addition to facilitating the study of dental positioning[15] and inclinations, instrumental in the diagnosis, prognosis and analysis of finished orthodontic cases.[16]

MATERIAL AND METHODS
Sample selection

The sample for this prospective study comprised individuals selected for orthodontic treatment in the department of graduate studies and met the following requirements: Permanent dentition, presenting with Angle Class II malocclusion without significant crowding (>2 mm); facial pattern II,[9] but with enough facial pleasantness[24] as to contraindicate orthodontic-surgical treatment. A group of 17 individuals was selected, 10 males and 7 females, aged between 16 years and 5 months, and 52 years and 11 months; 16 Caucasians and 1

Afro-descendant. Nine patients had Class II, division 1 malocclusion and 8 had Class II, division 2 malocclusion. Volumetric Computed Tomography (VCT) examinations were performed to obtain the proposed measurements. VCT was preferred as it allows measurements of each individual tooth[10] without superimposing images while providing images without magnification.[20,22]

Methods
Orthodontic treatment protocol

Patients were subjected to compensatory orthodontic treatment using Capelozza's[8] prescription II brackets with 0.022 X 0.028-in slots (Abzil, São José do Rio Preto, Brazil). Treatment was provided by a single specialist from start (bonding) to finish. Bonding was performed by implementing Andrews' bracket placement technique[2], i.e., using the center of the clinical crown as reference. Subsequently, a strict archwire progression protocol (Table 1) was performed ensuring that alignment and leveling occurred gradually without the intervention or use of any additional mechanical resources. Therefore, any changes in tooth position would be directly related to the gradual increase in size of the leveling archwires.

Archwire	Replacement(days)
0.014-in NiTi	30
0.016-in NiTi	30
0.016-in SS	30
0.018-in SS	30
0.020-in SS	30
0.019 X 0.025-in SS	40
0.021 X 0.025-in SS	40

TABLE 1 - Protocol used for orthodontic archwire progression.

CT image scanning

In order to perform the dental measurements, all sample patients were subjected to VCT scanning at three different times during the protocol described above:

» T1 - At the end of the leveling phase, using 0.020-in stainless steel (SS) archwire.

» T2 - At the end of the rectangular 0.019 X 0.025-in SS archwire period.

» T3 - At the end of the rectangular 0.021 X 0.025-in SS archwire period.

NewTom DVT-9000 Computed tomography equipment (NIM - Verona - Italy) was used to acquire the images. QR-DVT 9000 software was used for reformatting the images and measuring tooth inclinations.

Tooth inclination measurement

The method described by Capelozza, Fattori and Maltagliati[10] was implemented.

To be considered optimal for this sample tooth inclination values (Figs 1 and 2) had to be close to those of the prescription described by the manufacturer, taking into account a maximum allowed slack of ± 3.9°.[11] Therefore, the value of each inclination angle was analyzed in each subject at the three study times by adding or subtracting the value of the slack. Thus, each tooth was classified into one of three categories, within, above or below prescription values.

Statistical analysis

Analysis of systematic error was performed by paired t-test and random error was examined using Dahlberg's formula for all measurements, in 23.5% of the sample (n=4), 90 days after the first measurement. For random error, values above 1.5° were regarded as significant in terms of angular measurements, as suggested by Houston.[19]

Data normality was examined using the Shapiro-Wilk test (Table 2). Friedman's analysis of variance was used to compare data between the different times (T1, T2 and T3) due to the fact that some data exhibited abnormal distribution or unequal variances (Figs 3 - 8). Coefficient of variation was used to examine the variation between T1, T2 and T3.

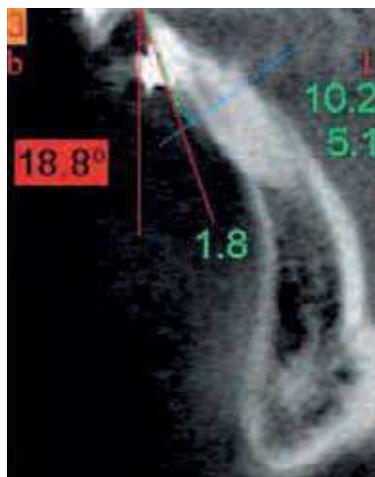A significance level of 5% was set for all statistical tests employed in this study.

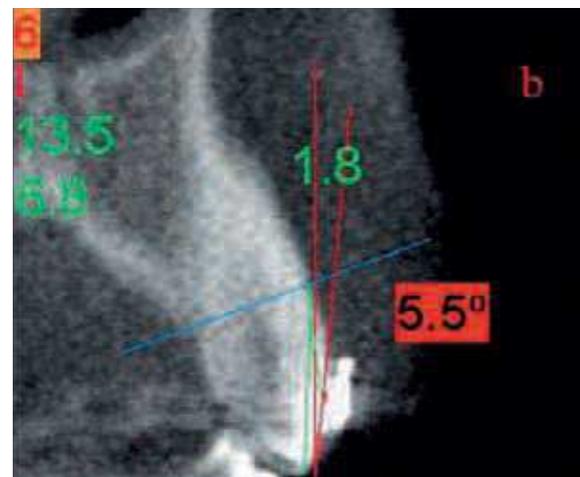FIGURE 1 - Positive inclination.

FIGURE 2 - Negative inclination.

TABLE 2 - Median (Med), Interquartile Deviation (IQD) and p value for the analysis of normality (Shapiro-Wilk) and for Friedman's analysis at T1, T2 and T3.

	T1 (0.020-in)		Normal	T2 (0.019 X 0.025-in)		Normal	T3 (0.021 X 0.025-in)		Normal	Capelozza Prescription	Friedman (P)
	Med	IQD	p (SW)	Med	IQD	p (SW)	Med	IQD	p (SW)		T1XT2XT3
Maxill. Canine	-1.80	3.40	0.08	-2.75	4.63	0.44	-2.45	4.05	0.61	-5	0.99 (ns)
Maxill. Lat. Inc.	7.00	3.40	<0.01**	7.20	4.75	<0.01**	7.05	4.63	<0.01**	3	0.13 (ns)
Maxill. Cent. Inc.	5.75	5.73	0.03*	6.20	6.15	0.02*	6.65	4.93	0.04*	7	0.07 (ns)
Mand. Canine	-4.95	8.03	0.04*	-6.10	5.48	0.09	-5.15	6.35	0.53	-11	0.44 (ns)
Mand. Lat. Inc.	4.70	4.08	0.05	5.60	3.00	0.02*	4.85	3.00	0.01*	4	0.013* (T1=T2)#T3
Mand. Cent. Inc.	6.00	5.15	0.19	7.50	4.68	0.02*	6.60	3.05	0.04*	4	0.15 (ns)

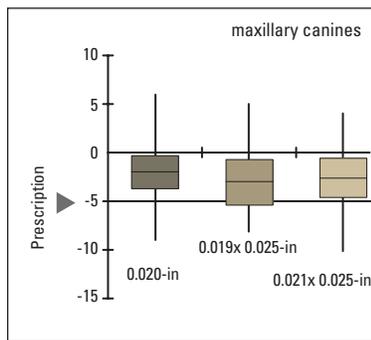*p<0.05/ **; p<0.01; SW= Shapiro-Wilk.

FIGURE 3 - Boxplot for maxillary canines (teeth 13 and 23). The solid line corresponds to Capelozza's Prescription value (-5º). Median values and coefficient of variation between the groups were similar between the three times (T1=T2=T3).
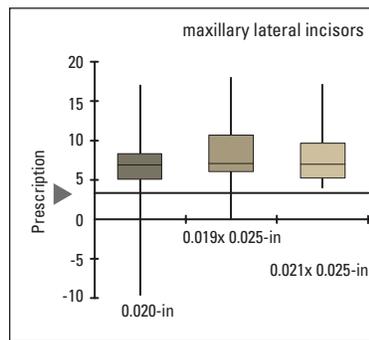

FIGURE 4 - Boxplot for maxillary lateral incisors (teeth 12 and 22). The solid line corresponds to Capelozza's Prescription value (+3º). Median values were similar between groups (T1=T2=T3). However the range of values obtained at T1 was significantly wider compared to the T3 group (p<0.01).

FIGURE 5 - Boxplot for maxillary central incisors (teeth 11 and 21). The solid line corresponds to Capelozza's Prescription value (+7º). Median values were similar between groups (T1=T2=T3). However the range of values obtained at T1 was significantly wider compared to the T3 group (p<0.01).
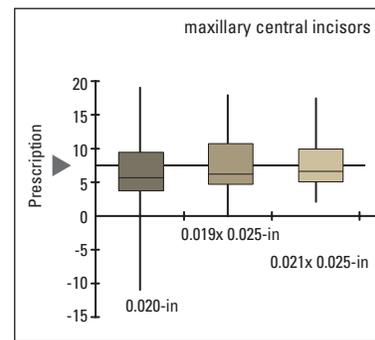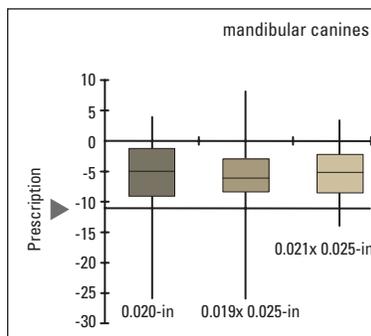

FIGURE 6 - Boxplot for mandibular canines (teeth 33 and 43). The solid line corresponds to Capelozza's Prescription value (-11º). Median values were similar between groups (T1=T2=T3). Although the range of values obtained at T1 seems wider, no significant difference was found.
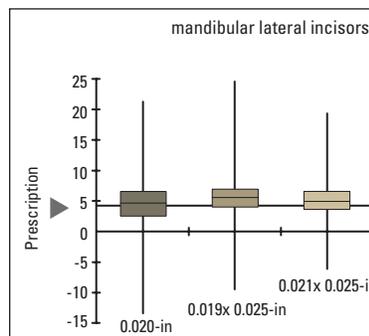

FIGURE 7 - Boxplot for mandibular lateral incisors (teeth 32 and 42). The solid line corresponds to Capelozza's Prescription value (+4º). Median differences between groups T1≠T2 and T2≠T3. Variation between the groups was similar.
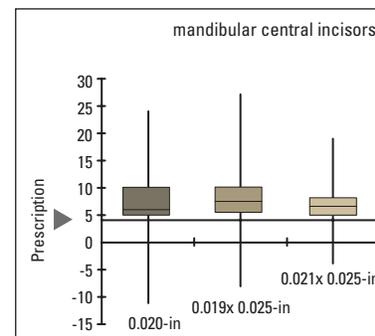

FIGURE 8 - Boxplot for mandibular central incisors (teeth 31 and 41). The solid line corresponds to Capelozza's Prescription value (+4º). Median values and coefficient of variation between the groups were similar between the three times (T1=T2=T3).

RESULTS

The systematic error test showed no statistically significant differences in none of the teeth at the three different times, with the sole exception of tooth 32, which showed a value of p=0.043 when the 0.021 0.025-in (T3) archwire was examined. No representative value (> 1.5 °) was found for random error.

Normality values (Shapiro-Wilk)
T1 (0.020-in archwire) and
Capelozza's Class II Prescription

Comparing tooth inclination values at T1 with the prescription, a prevalence of individual patient values was noted due to different measurements among individuals. This result was expected, since it referred to a phase of round wire use, and little changes in inclination were expected, as round archwires cannot express torque. Therefore, any change in inclination at this stage can be attributed to adjustments in alignment and as a result of angular values built into lower anterior brackets. It should be noted, however, that both maxillary and mandibular central incisors exhibited median torque values that were close to the prescription used in the study. This finding suggests that in the presence of skeletal discrepancy, like that of the individuals in this sample, a natural compensation takes place, especially in mandibular teeth, which showed positive values close to the prescription, although such values were different from standard prescriptions, applicable to individuals with proportionate basal bones (-1°). Furthermore, maxillary teeth displayed values close to normal since prescription II features values that are identical with those of standard prescriptions, confirming that in pattern II malocclusions, increased compensation also occurs in the lower arch.[8]

T2 (0.019 X 0.025-in archwire) and
Capelozza's Class II Prescription

This detachment of prescription values from the median, observed during the first use of a rectangular wire, means that 0.019 X 0.025-in archwires did not express the inclinations incorporated into the preadjusted brackets but, on the contrary, yielded even higher values. This behavior may result from a greater vertical filling of the bracket slot by the archwire responsible for finishing alignment. The dental crowns are therefore moved to a more buccal position (Fig 9) by a lack of available spaces but without expressing the torque values built into the prescription due to the amount of slack, which is enough to compromise torque efficiency. Thus, one can assume that the main function of rectangular 0.019 X 0.025-in archwires is to finish leveling, and not to express numerically the angular inclination values present in the prescription, as previously believed. Therefore, if the expression of these torques in anterior teeth is desired, this archwire does not seem to be the most appropriate choice.

T3 (0.021 X 0.025-in archwire) and
Capelozza's Class II Prescription

When this archwire was in use, many teeth still showed values that were different from the prescription. However, median inclination values were harmonized for all teeth, causing them to exhibit more similar values between the teeth of the same group, but in opposing quadrants. This fact is clinically significant because it represents movement toward symmetry.
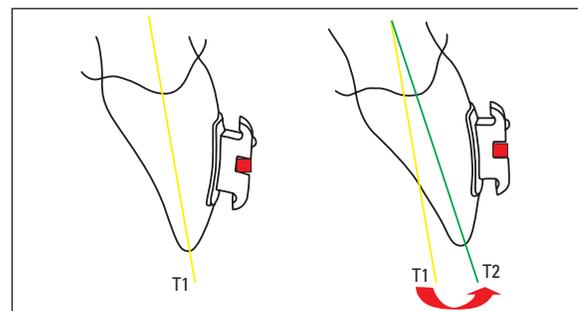

FIGURE 9 - Effect on tooth inclination at T2. Unaffected by the inclination provided in the prescription, the rectangular 0.019 X 0.025-in archwire caused labial inclination in order to finish leveling.

Statistical analysis between the values found at each of the three times showed no statistically significant difference during the test between T1 and T2 (0.020 and 0.019 X 0.025-in) and between T2 and T3 (0.019 X 0.025-in and 0.021 X 0.025-in). Statistically significant differences were found only between T1 and T3 (0.020-in and 0.021 X 0.025-in) for the following groups of teeth: maxillary central incisors (p=0.0023) and maxillary lateral incisors (p=0.0055).

Slack between bracket slot and archwire

Taking into account the maximum slack for the 0.021 X 0.025-in archwire (± 3.9°),[11] it was found that after this archwire had done its job, the inclination values of all teeth examined began to approach the torque values built into Class II brackets. It can be asserted that the prescription values tended to be expressed at this time. It was also found that, in terms of the slack between archwire and bracket slot, the percentage of teeth whose torque values approached the prescription values increased between times (Table 3).

Of the 204 teeth examined at T1, 52.9% (108 teeth) were within the prescription range, 13.2% (27 teeth) had values below the prescription and 33.8%, i.e., 69 teeth were above prescription. At T2, the values remained unchanged when compared with those that were above or below the prescription. As at T1, the same 52.9% (108 teeth) were found to be within the prescription range, with 38.7% above prescription values (79 teeth), while 17 teeth, i.e., 8.3% displayed lower values. At T3, however, a tendency was noted whereby the number of teeth within the prescription range rose to 59.8% (122 teeth). Those above prescription declined to 35.8% (73 teeth), and those below prescription decreased to 4.4% or 9 teeth.

The results displayed in Table 3 allow the following explanation. At T2 the number of teeth within the prescription was found to be the same as at T1, which confirms the finding that smaller-caliber rectangular archwires are unable to fully express the torque values built into the bracket prescription. Nevertheless, there was an increase in the number of teeth whose values were above prescription, which can be explained by the action of leveling, as it causes greater proclination of anterior teeth by increasing the perimeter of the dental arches. These data confirm that 0.019 X 0.025-in archwires work primarily for leveling.

The values found at T3 indicate that 0.021 X 0.025-in archwires successfully express the bracket prescription. The number of teeth that reached the torque values built into the brackets increased from 52.9% at T1 and T2, to 59.8%, or 122 teeth, at T3. These data clearly confirm that 0.021 X 0.025-in archwires are the only ones capable of adequately expressing inclination values, leading to a decrease in the number of teeth whose values were above and below the prescription (Fig 10).

Nonetheless, some teeth failed to exhibit inclination values within the prescription's range of tolerance which—for 0.021 X 0.025-in archwires—would be +4° of torque in the mandibular incisors, ±3.9° slack between bracket slot and archwire (Fig 11).

DISCUSSION

The theme of tooth inclination has been extensively debated in orthodontics as it is part and parcel of daily orthodontic practice since the advent of preadjusted brackets. However, oddly enough, there are no published studies on the behavior of this feature, which is present in these orthodontic appliances. Nor has there been any research on how these preprogrammed brackets affect different individuals and different techniques, or the magnitude of changes in each tooth when different archwire calibers are employed. The most reasonable explanation for this gap is that the findings would probably dispel

TABLE 3 - Number of teeth whose inclination values were within the prescription, considering a ± 3.9° slack, according to Creekmore[11].

|	T1			T2			T3		
	within prescription	above	below	within prescription	above	below	within prescription	above	below
13	14	3	0	12	5	0	11	5	1
12	5	10	2	6	11	0	7	10	0
11	9	4	4	11	4	2	12	4	1
21	13	2	2	12	4	1	13	4	0
22	10	6	1	11	6	0	9	8	0
23	9	8	0	12	5	0	11	5	1
43	3	10	4	3	10	4	7	10	0
42	12	2	3	11	3	3	13	3	1
41	9	5	3	7	8	2	11	4	2
31	7	7	3	7	8	2	10	5	2
32	10	3	4	9	5	3	13	3	1
33	7	9	1	7	10	0	5	12	0
Total	108	69	27	108	79	17	122	73	9
Percentage	52.9%	33.8%	13.2%	52.9%	38.7%	8.3%	59.8%	35.8%	4.4%
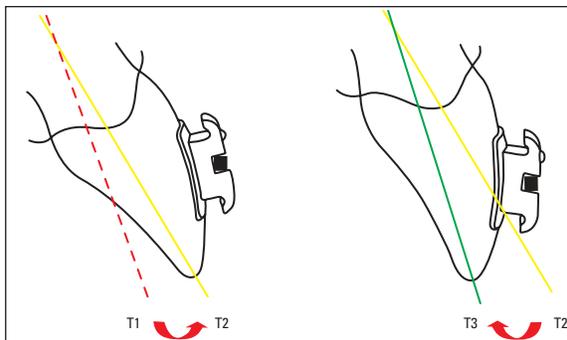
FIGURE 10 - Effect on tooth inclination from T1 to T2 and from T2 to T3. The inclination prescription influenced the effect of the 0.021 X 0.025-in archwire on the position of the teeth.
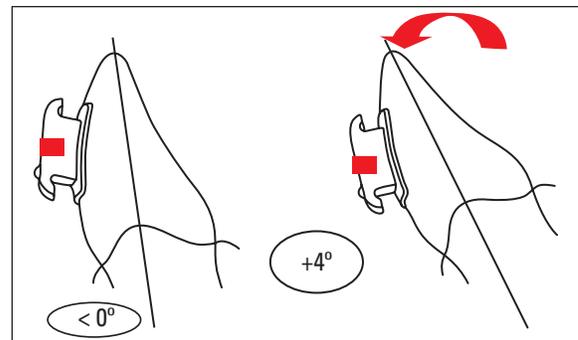

FIGURE 11 - Effect at T3 on the teeth whose values were below the prescription.

the misconception that 'one prescription fits all cases' and lay bare the need for bracket individualization and a selective use of archwires and even so, the difficulties in controlling the results expressed in the final position of the teeth would not be easily surmounted.

Most orthodontists use a single prescription because they do not use larger-caliber archwires to finish their cases, which results in loss of control over the full expression of prescription, especially in terms of inclination. This allows similar brackets to be used in different patients with distinct therapeutic goals.[12]

Andrews'[5] standard prescription, however, emerged from measuring the crowns of teeth on normal occlusion models. Variation in incisor inclination was wider than that of other teeth, a characteristic attributed to different skeletal patterns present even in patients with optimal occlusion. For this reason, Andrews has suggested

since the introduction of Straight-Wire that individual prescriptions be employed using three torque values for the incisors in order to accommodate compensable inter-maxillary Class I, II or III relationships. Interestingly, this concept has aroused very little attention in the vast universe of those who routinely use this technique.

In this study, assessment of inclinations in anterior teeth was performed as of the stage when round the 0.020-in stainless steel archwire stopped being used. The results were used as inclination reference for comparison with the effects produced by rectangular 0.019 X 0.025-in and 0.021 X 0.025-in archwires. The use of rectangular wires aimed to induce the highest possible expression of the inclinations built into the brackets and, therefore, they were kept inserted for longer than the round wires, 40 and 30 days, respectively. It was only after this period that CT images were acquired.

It is important to stress that the slack between a 0.019 X 0.025-in archwire and the bracket slot is 10.5°.[11] Theoretically, this is a very high value and a significant expression of the prescription can be therefore expected in the anterior teeth in terms of inclination. From this perspective, the 0.021 X 0.025-in archwire was the last to be used, with a 3.9° slack[11] since it is potentially better able to express the prescription. It was thus possible to assess and compare the behavior of all archwires and brackets, always taking into consideration the slack between archwire and bracket slot.

The absence of statistically significant differences in the values of tooth inclination between the three times (T1, T2 and T3) for most teeth analyzed in this study can be attributed to the similarity between the torque values in the prescription and those found in the first phase, when the round 0.020-in archwire was used. This fact has a direct bearing on the means and statistical results. Some individuals showed little difference between the three moments (T1, T2 and T3) and others showed great differences, which caused an increase in result variability.

For both lateral and central maxillary incisors, the statistical differences found between the round archwire and the rectangular archwires that filled the bracket slot maximally can be ascribed to the fact that the prescription reading was based on these teeth, for most individuals examined in this sample. In the Class II sample, the selection was made for both those subjects whose anterior teeth had buccal (Class II, division 1) and lingual (Class II, division 2) inclinations. By using rectangular 0.021 X 0.025-in archwires, these teeth reached values that differed from their initial values, as well as, from the values found when round archwires were used. This effect did not occur with any other tooth examined in this study.

CLINICAL CONSIDERATIONS

At this point in this article it seems important to highlight the clinical insights that can be inferred from the results. Much has been said about the individualization of orthodontic treatment by means of an accurate, differential and individualized diagnosis with a view to determining the best treatment plan for each individual. This concept encompasses the choice of orthodontic brackets, a key issue often neglected by users of the Straight-Wire technique. This technique requires that brackets be chosen according to the final position of the teeth, which varies from patient to patient.

The sample selected for this clinical research was conducted in a judicious manner on individuals with an indication for Capelozza's prescription II. Despite such stringent selection, different inclinations were observed between individuals with identical facial pattern and malocclusion. This is perfectly natural as it represents the universe of patients expected in routine clinical practice. Although the median values found in this study are close to the

prescription values, inclinations varied widely between individuals, even at the three different assessment times.

Some teeth displayed a unique behavior, such as the maxillary central incisors. Inclination values varied little at each time, regardless of archwire size and its effect on anterior teeth. Despite the proclination tendency shown by 0.019 X 0.025-in archwires, torque values for these teeth remained at around +7°, a value suggested by Andrews[5] as ideal and used in Capelozza's prescription II. This finding regarding the central incisors is also corroborated by another study in which, although the value (0.96°) was higher than the one found by Andrews, it is not clinically significant.[7]

This information reinforces the recommendation that a +7° torque be built into the Class II prescription for central incisors which, unlike the +2° prescription suggested by Andrews,[5] do not have their inclination values decreased. The argument in favor of maintaining +7° in maxillary incisor inclination, even in brackets designed for compensatory treatment of Pattern II malocclusions, stems from the need to give resistance to these teeth in the face of other mechanical resources used to treat this malocclusion, such as headgear and Class II elastics, thereby minimizing the tendency towards a more vertical position. Thus, any compensation for tooth inclinations occurs in the lower arch in order to prevent the negative aesthetic impact that takes place when maxillary teeth are inclined in an attempt to compensate for the facial pattern.[8]

A unique behavior was also noted in maxillary lateral incisors, which exhibited values well above those found in the sample of normal occlusions suggested by Andrews[5] and above Class II prescription values.[8] This seems due to the fact that the means were influenced by individuals who presented with Class II, division 2 malocclusion.

In the maxillary canines a behavior was noted which differs from that found in other teeth during the transition of T1, T2 and T3. Clinically, it was observed that in each individual, the initial position of the canines tended to remain unchanged. Thus, if one of the teeth exhibited an inclination that was altogether different from its analogue in the opposite quadrant, such difference in position was maintained despite the use of rectangular wires. This finding attests that the importance of canine position, and the impact it exerts on other teeth, especially in terms of inclination, cannot be overemphasized. The size of the root may have been the main obstacle to the full expression of the prescription inclination, despite the use of larger-caliber rectangular archwires.

Also based on the results of this study, but now seen from a clinical perspective, it seems reasonable to emphasize that the 0.019 X 0.025-in archwire should be primarily regarded as a leveling archwire, since its major effect is to procline incisors (Fig 12), irrespective of the prescription built into the bracket.
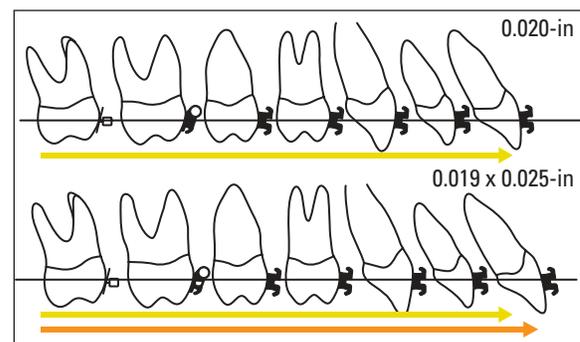

FIGURE 12 - Proclination effect and increase in arch perimeter in the transition from T1 to T2.

Therefore, to ensure that the inclination values of a given prescription are fully expressed, it is advisable to use larger-caliber rectangular archwires, e.g., 0.021 X 0.025-in in a 0.022-in slot. It would also be reasonable to assume that this wire should be maintained for a longer period of time to produce a more effective prescription expression.[11]

As for the orthodontic treatment of the sample, it must be emphasized that there was a reduction, if not a complete correction, of overjet in these individuals, even without the use of any additional mechanical resources. This probably occurred in a compensatory manner, through changes in their inclinations.

The use of individualized prescriptions can be helpful in creating or maintaining the inclinations and angulations necessary to achieve the planned movements, which ultimately compensate for pattern II malocclusions by facilitating, and not hindering, these movements.

When planning an orthodontic case, orthodontists envision the positioning of teeth, in terms of the desired inclinations and movements, with the purpose of attaining an interincisor relationship that is acceptable both esthetically and functionally. As regards the individuals selected for this scientific research, it is expected that the mandibular incisors will remain or become proclined, i.e., with a positive inclination value. Upper incisors should also undergo proclination, in line with dental and facial esthetics. Values, however, should not be too high but nominally equivalent to the values built into the prescription.

The use of the prescription can still be advocated given the increased value used in the mandibular canine angulation. This angulation makes for lower incisor proclination. It should be emphasized once again that in the absence of mandibular canine proclination, which should be expected as compensation for Pattern II, the prescription would help achieve the best possible positioning. On the other hand, in the presence of an increased angular value, the prescription would ensure its maintenance.

CONCLUSIONS

Based on the methodology used in this investigation and the results it achieved, it seems reasonable to state that:

» The median inclinations found at T1, T2 and T3 were similar. Statistical significance was found only for mandibular lateral incisors.

» The use of rectangular 0.021 X 0.025-in archwires reduces inclination variation, mainly in maxillary incisors, thereby increasing the number of teeth whose values come close to the prescription built into the bracket.

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