

Profile of the orthodontist practicing in the State of São Paulo - Part 2

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Introduction: The choice of brackets, bands and wires is a very important aspect of orthodontic treatment. Stainless steel prevailed for a long time, but new alloys and resources have emerged to diversify the orthodontic wire mechanics. **Objective:** This study aimed to investigate the profile and materials used by orthodontists practicing in the State of São Paulo, Brazil. **Methods:** A questionnaire was sent to 2,414 specialists in Orthodontics and Dentofacial Orthopedics registered with the Regional Board of Dentistry of São Paulo State (CRO-SP). To assess the association between qualitative variables, the Chi-square association test was employed at 5% significance level. **Results:** Five hundred and ninety-three (24.65%) questionnaires were completed and sent back. Efficiency was the key reason given by the professionals for choosing a particular material. The majority showed a preference for metal brackets (98%), followed by ceramics (32%) and polycarbonate (7.8%). The most widely used brackets had 0.022 x 0.028-in slots (73.2%). Regarding orthodontic wires, 88.2% employed round steel wires and conventional round NiTi wires, while 52.6% used round heat-activated NiTi and 46.5% rectangular TMA wires. Elastics (92.9%) were the most widely used method to tie the orthodontic archwire to the bracket. **Conclusions:** In this survey, the orthodontists claimed that efficiency was the major motivator for choosing orthodontic materials. Conventional brackets tied with conventional elastic ligatures are still the most used by the professionals. Among steel and conventional Nitinol wires, round wires ranked first. The use of resources recently available to Brazilian orthodontists, such as self-ligating brackets and mini-implants, was not significant.

Keywords: Orthodontics. Dental research. Materials.

Introdução: a escolha do tipo de braquetes, ligaduras e fios são fatores importantes no tratamento ortodôntico. O aço inoxidável predominou por muito tempo, mas novas ligas metálicas diversificaram o universo de fios disponíveis, assim como surgiram outros recursos. **Objetivo:** analisar o perfil do ortodontista do estado de São Paulo em relação aos materiais que utiliza. **Métodos:** foi enviado um questionário a 2414 especialistas em Ortodontia e Ortopedia Facial inscritos no Conselho Regional de Odontologia do estado de São Paulo. Para avaliar a associação entre as variáveis qualitativas, foi utilizado o teste qui-quadrado, ao nível de significância de 5%. **Resultados:** houve o retorno de 593 (24,65%) questionários preenchidos. A eficácia do material ortodôntico foi o principal motivo alegado para sua escolha. A maioria demonstrou preferência por braquetes metálicos (98%), cerâmicos (32%) e de polycarbonato (7,8%). O *slot* mais citado foi o de 0,022” x 0,028” (73,2%). Sobre os fios ortodônticos, 88,2% empregam fio de aço redondo e o NiTi convencional redondo; 52,6% o NiTi termoativado redondo e 46,5% o TMA retangular. A ligadura elástica foi a forma mais empregada (92,9%) para fixar o arco ortodôntico ao braquete. **Conclusões:** os ortodontistas analisados alegaram ser a eficácia o principal motivo de escolha do material; os braquetes convencionais unidos com ligaduras elásticas ainda são os mais utilizados. Entre os fios ortodônticos, os de secção redonda apareceram em primeiro lugar, tanto os de aço como os de nitinol convencional. Recursos recentes na Ortodontia brasileira, como os braquetes autoligáveis e os mini-implantes, não apresentaram uso significativo.

Palavras-chave: Ortodontia. Pesquisa em Odontologia. Materiais.

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INTRODUCTION

In orthodontics, as well as in other fields of dentistry, there is a constant search for new materials and resources in order to increase the efficiency of orthodontic mechanics, biosecurity and patient comfort, and facilitate the clinical performance.

In recent years manufacturers have diversified the composition of orthodontic wires by changing the biomechanical properties, such as formability and performance, when subjected to temperature changes.⁵

Self-ligating brackets have been developed to minimize mechanical problems such as friction, self-ligating brackets also eliminate the use of ligatures, reducing chair time when placing and removing the orthodontic archwire and minimize biofilm retention.¹⁰

The advent of mini-implants has provided clinical solutions to certain limitations, such as tooth intrusion and orthodontic movement in the posterior region of the archwire, enabling greater control and mechanical safety while reducing treatment time.^{1,12,22,23}

On the other hand, acceptance of a new technology depends on many factors, such as scientific validation as well as changes in professional conduct.

This is the second part of an extensive study conducted to define the profile of orthodontists practicing in the State of São Paulo. In the first part, an analysis of orthodontics specialists was conducted involving gender, age, time of registration with the Regional Board of Dentistry of São Paulo, most frequently used cephalometric analyses, preferred orthodontic technique and use of functional orthopedic resources.

The present study aimed to determine the profile of orthodontists who practice in the State of São Paulo with respect to the materials most commonly used regarding: Brackets, orthodontic wires, ligatures and mini-implants.

MATERIAL AND METHODS

To conduct this research the Regional Board of Dentistry of São Paulo was requested to provide a list of addresses of all specialists in Orthodontics and Facial Orthopedics registered by May 2007, comprising a total of 2,414 professionals.

The questionnaire comprised 20 objective questions, eight of them could be checked more than one alternative. Additionally, 10 questions allowed professionals to add a written response with a descriptive text.

The questionnaire was printed on 120 g A4 sulfite paper, including a prepaid reply letter and the inside was divided into two equal parts, with the upper part containing a free and informed consent form, which clarified professionals about the nature of the survey, while the lower portion of the sheet comprised the questionnaire. Odd-numbered questions were shaded for enhanced visualization and make it easier to read.

A prepaid reply service agreement was signed with the Post and Telegraph Company. This service exempted respondents from any expenses. Professionals received the questionnaire at the registered addresses. Care was exercised to ensure that the letters did not reach the destination near the weekend, but preferably earlier in the week, when prepaid reply letters are more likely to be returned.¹⁴

Based on the responses to the questionnaires an attempt was made to fully describe and interrelate the information in order to extract as much data as would be required to reach conclusions consistent with the purpose of this study.

Computer software, i.e., Microsoft Excel[®] and Microsoft Windows[®] XP's graphical wizard, were used for data entry and spreadsheet preparation.

Questionnaire responses were analyzed through charts and tables and classified according to either absolute (n) or relative frequency (%). To assess the association between qualitative variables, the Chi-square association test was applied. When the chi-square test was significant, adjusted residual analysis was used as a complement. Statistical analysis was performed using software SPSS[®] version 13.0.

RESULTS

Efficiency (81.1%) appeared as the key motivator for choosing the materials used by orthodontists, often combined with other factors such as cost (23.4%), availability on market (17.5%) and simplicity for use (15.5%).

Responses regarding brackets denote a preference for metal (98%), as shown in Table 1, and for 0.022 x 0.028-in slots (73.2%), as shown in Table 2. Regarding self-ligating brackets, most professionals (56.2%) stated that they knew about them but did not use them, 25% reported not knowing about them, and only 4.7% used it frequently (Fig 1).

The use of self-ligating brackets is related to the time the professional graduated as a specialist (between 11 and 15 years), as demonstrated by the chi-square test, complemented by adjusted residual analysis at 5% significance level (Table 3).

Most orthodontists (92.9%) reported using elastic ligatures to tie the wire to the bracket when performing orthodontic mechanics while 76.1% made use of ligature wire (Table 4).

Regarding the types of wires orthodontists use routinely 88.2% use conventional round NiTi wire; (52.6%) heat-activated round NiTi wire; (46.5%) rectangular TMA wire. (4.1%) Elgiloy wire (Table 5).

Table 1 - Distribution of orthodontists according to types of brackets used routinely.

	n	%
Metal	581	98.0
Ceramic	190	32.0
Composite	46	7.8
Self-ligating	16	2.7
Other	13	2.2
Total	593	-

Multiple response questions.

Table 2 - Distribution of orthodontists according to slot size of brackets used routinely.

	n	%
0.022 x 0.028-in	434	73.2
0.018 x 0.025-in	131	22.1
Combined slots	20	3.4
Did not reply	8	1.3
Total	593	-

Multiple response questions.

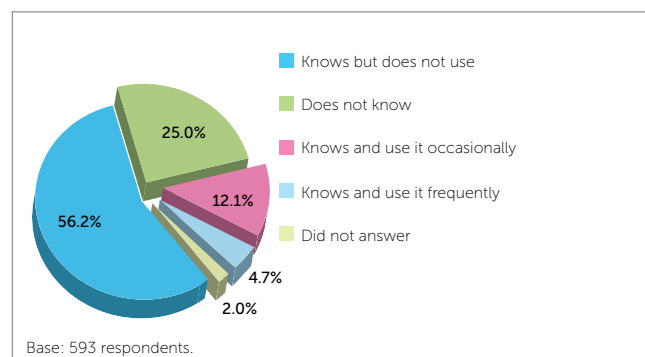


Figure 1 - Distribution of orthodontists according to knowledge and use of self-ligating brackets.

These questions were grouped and concerned mini-implants. In the first part, as shown in Figure 2, orthodontists' responses concerned the use of this resource. In the second part, if the professional uses mini-implant, information about the clinical situation in which they employ mini-implants was assessed (Table 6).

The chi-squared test, $p = 0.384$, disclosed no association between 1 time that orthodontists have been in clinical practice and use of mini-implants (Table 7).

DISCUSSION

It should be pointed out that the literature lacks for data about Brazilian orthodontists, especially regarding the materials they use routinely, which was the object of this study.

According to the data, orthodontists are deeply concerned about the quality of the materials they use and reported that efficiency was the main feature motivating their choice. Secondarily other reasons such as cost, simplicity and convenience were mentioned as factors to be considered when purchasing orthodontic products.

Table 3 - Distribution of orthodontists according to time of speciality practice and use of self-ligating brackets.

Time of orthodontic practice	Self-ligating brackets						Total	
	Does not know		Knows but does not use		Use		n	%
	n	%	n	%	n	%		
1 to 5	36	24.8	97	29.6	21	22.1	154	27.1
6 to 10	48	33.1	105	32.0	18	18.9	171	30.1
11 to 15	17	11.7	51	15.5	27	28.4*	95	16.7
More than 15	44	30.3	75	22.9	29	30.5	148	26.1
Total	145	100	328	100	95	100.0	568	100

$\chi^2=19.89$; $p = 0.003$.

*Adjusted Residual Analysis: $p < 0.05$.

Table 4 - Distribution of orthodontists according to the methods used to tie the wire to the orthodontic bracket.

	n	%
Elastics	551	92.9
Ligature wire	451	76.1
Self-ligating	14	2.4
Other	2	0.3
Total	593	-

Multiple response questions.

Table 5 - Distribution of orthodontists according to the types of orthodontic wires most used.

		n	%
Steel wire	Round	523	88.2
	Rectangular	483	81.5
	Square	140	23.6
	Twisted	188	31.7
Conventional NiTi wire	Round	523	88.2
	Rectangular	370	62.4
	Square	88	14.8
Heat-activated NiTi wire	Round	312	52.6
	Rectangular	251	42.3
	Square	47	7.9
TMA wire	Rectangular	276	46.5
	Round	129	21.8
Other	Elgilloy	24	4.1
	Other	13	2.2
Base		593	-

Multiple response questions.

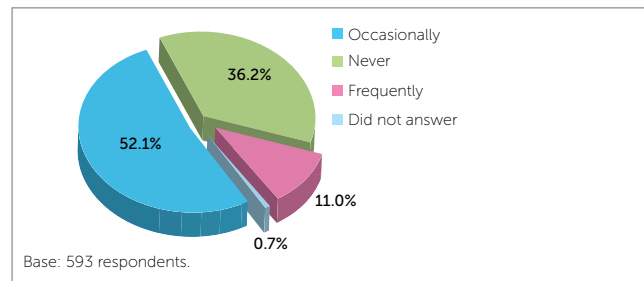


Figure 2 - Distribution of orthodontists according to the use of mini-implants.

Table 6 - List of medical conditions mentioned by orthodontists using mini-implants.

	n	%
Anchorage	193	51.6
Intrusion	91	24.3
Distalization and mesialization	45	12.1
Retraction	42	11.2
Molar uprighting	24	6.4
Others	32	8.6
Total	374	-

Table 7 - Relationship between time of orthodontic practice and use of mini-implants.

Time of orthodontic practice (in years)	Mini-implants								Total	
	Never		Occasionally		Frequently		Did not reply		n	%
1 to 5	67	31.6	74	24.6	17	27.0	1	25.0	159	27.9
6 to 10	71	33.5	82	27.2	20	31.7	1	25.0	174	30.0
11 to 15	27	12.7	57	18.9	11	17.5	1	25.0	96	16.6
More than 15	47	22.2	88	29.2	15	23.8	1	25.0	151	26.0
Total	212	100	301	100	63	100	4	100	580	100

$\chi^2=9.60$; $p = 0.384$.

Preference for conventional metal brackets (98%) was high and coincided with the results of other studies.^{7,8,11} This finding showed that metal brackets are still the most used probably because it is easy to use, purchase and is affordable.

However, with respect to ceramic brackets, which ranked second in this study (32%), results were significantly lower compared to the percentage of use reported by US professionals.^{7,8,11} Although a justification was not requested for the professionals surveyed, factors such as higher costs, reports of ceramic bracket fractures, tooth abrasion of antagonists when

in premature contact and debracketing difficulties¹⁷ are probably linked to this outcome.

Furthermore, self-ligating brackets are used by 2.2% of orthodontist who practice in São Paulo State, a percentage similar to US data reported in 1996 (1.6%) by Gottlieb et al.¹⁰ The results, however, are lower if compared to more recent studies, since 9.8% of US orthodontists reported using these brackets in a study conducted in 2002.¹³ Another study carried out recently in the United Kingdom² showed a 11% of use. Taken into account the concentration of professionals in São Paulo State and the

convenient access to suppliers compared to other regions of the country the use of this resource in Brazil can be considered negligible.

Statistical analysis showed that the use of self-ligating brackets is associated with dentists who have been orthodontics specialists for 11 to 15 years. This result leads one to question whether this is due only to the higher cost of this type of bracket, which might restrict its use to patients with higher purchasing power. An additional issue concerns the fact that professionals who have been specialists for 15 years possess a broader scientific background, which affords them greater insight when choosing materials, as well as a more accurate judgment since self-ligating brackets were released with the purpose of promoting more effective treatments and less friction.⁶

On the other hand, preadjusted appliances can promote greater risk than conventional appliances when used by inexperienced professionals. Based on this context, orthodontists need to have been well trained before they can recognize poor individual tooth positions and adequately perform biomechanical procedures that allow torque individualization and tooth angulation, which are only accomplished by more experienced professionals.

It should be recalled that orthodontists nowadays have available passive and active self-ligating brackets, each featuring both advantages and disadvantages. In 2002, Thorstenson²⁸ compared sliding mechanics in both systems and found that resistance to sliding is zero in passive systems, which was associated with potential lack of control in positioning the tooth root. Regarding active systems, resistance to sliding ranged from 12 to 54 g. In conventional brackets resistance to sliding is higher, especially if elastic ligatures are employed.¹⁵

The choice between the two brackets must take into consideration several factors. From product availability to price, manufacturing quality and clinical advantages, depending on the characteristics of the clinical case selected for treatment.¹⁶

Regarding slot dimensions, the results showed a preference for 0.022 x 0028-in (73.2%) compared to 0.018 x 0.025-in (22.1%), corroborating the outcomes of similar studies conducted in other countries.^{2,11}

When interviewed, most respondents reported using elastic ligatures routinely in clinical practice

(93%), despite limitations such as strength degradation due to thermal action of food and oral temperature, and physical-chemical reaction to saliva.⁶ Simplicity of use, possibility of increasing friction when needed and low cost were the main benefits cited to justify the choice.¹⁰

Stainless steel orthodontic wires were long prevalent in orthodontics, but the advent of new alloys brought a wide range of new wires.⁹ The preference for round stainless steel Nitinol (NiTi-M) wires yielded similar results. Similar results were also reported^{2,11} and justifiably because Nitinol is usually highly recommended at the beginning of treatment, a stage that requires wires to be highly elastic and resilient, while stainless steel is used when finishing cases as it enables case detailing.⁹

Superelastic wire, heat-activated NiTi, A-NiTi and active nickel-titanium have been achieved great acceptability during the 90's for providing superelasticity combined with memory.⁵ These wires have been extensively accepted by the orthodontists surveyed (52.6% prefer round wires and 42.3% rectangular) compared with the findings of Gottlieb et al¹⁰ (24.9%) and Keim et al¹³ (26.8%). However, according to Sheridan,²⁴ 85% of professionals use them routinely in the initial phase of treatment.

TMA wire (titanium-molybdenum alloy) is mainly characterized by high resilience combined with moderate formability.⁹ In the USA, Gottlieb et al¹⁰ reported that 22.5% of professionals used routinely TMA wires, Keim et al¹³ reported that 13.5% of respondents used at the beginning of treatment and 16.6% in the final stage of treatment. The present study revealed that the use of 46.5% of rectangular TMA wire and 21.8% of round wires yielded more significant results than those found in U.S. studies, although still insufficient to outweigh the use of stainless steel and Nitinol wires.

Cobalt-chromium alloy for orthodontic wires was developed in the 60's and marketed under the name "Elgiloy"[®] (Rocky Mountain Orthodontics). Currently, similar products are available on the market. Limitations such as higher cost, similar stiffness and a slightly more friction than steel alloy⁹ can explain the limited use of TMA among the professionals surveyed (4.1%), as was also found by the study of Keim et al¹³ with 8.3% being routinely used at the beginning of

treatment and 3% at the end of treatment. In previous research by Gottlieb et al,^{9,10} Elgiloy wires were not even mentioned.

The phase of orthodontic anchorage preparation is very important in determining treatment success²² besides being useful when treating non-compliant patients.²⁰ For this reason, the professionals under study were inquired about the use of mini-implants. It was found that 11% of the sample orthodontists routinely use them, a finding similar to that of Sheridan,²⁴ who found more than 8%, and higher than Banks et al,² who reported that mini-implants were used by only 2% of respondents in the UK. Still, 51.6% of dentists reported using mini-implants as

anchorage^{1,12,23} and 24.3% combined them with intrusion biomechanics in order to optimize results, given the difficulty inherent in this orthodontic movement.²²

CONCLUSIONS

In this study, the orthodontists claimed that efficiency was the major motivator for choosing orthodontic materials. Conventional brackets tied with elastic ligatures are still the most used. Stainless steel and conventional Nitinol round wires ranked first in the survey. Resources recently made available to Brazilian orthodontists, such as self-ligating brackets and mini-implants did not exhibit significant use.

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