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Stainless Steel: Material Facts for the Orthodontic Practitioner

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Abstract. Stainless steel is one of the most widely used materials in current orthodontics. Archwires, brackets, bands, ligatures, tubes, among other appliances, are manufactured using different types of this alloy. The first evidence of the use of this alloy in the orthodontic field dates back to the mid-1920s, when it was introduced as a material to manufacture wires. The alloy has ever since gained popularity among orthodontists and its further development has led to its widespread use in today's different orthodontic techniques. Despite being available for more than 80 years, and the fact that most orthodontists use it on a daily basis, there is still a lack of knowledge about the basic principles, composition, and properties of this material by these professionals. Therefore, the purpose of this literature review is to discuss the main characteristics and properties of stainless steel that are useful in the orthodontic practice for orthodontists to take advantage of this remarkable material.

Keywords: stainless steel, orthodontic wires, austenitic, orthodontic brackets.

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Acero inoxidable: hechos significativos para el ortodoncista practicante

Resumen. El acero inoxidable es uno de los materiales más ampliamente utilizados en la ortodoncia actual. Los arcos de alambre, *brackets*, bandas, ligaduras, tubos, entre otros aparatos, se fabrican utilizando diferentes tipos de esta aleación. La primera evidencia del uso de esta aleación en el campo de la ortodoncia se remonta a mediados de la década de los veinte cuando se introdujo como un material para fabricar alambres. Desde ese entonces, esta aleación ha ganado popularidad entre los ortodoncistas y su desarrollo posterior ha llevado al uso extendido en las diferentes técnicas de ortodoncia de la actualidad. A pesar de haber estado disponible por más de ochenta años, y del hecho de que la mayoría de los ortodoncistas lo usan a diario, todavía existe un desconocimiento acerca de los principios básicos, la composición y las propiedades de este material por parte de estos profesionales. Por tanto, el objeto de esta revisión de la literatura es discutir las principales características y propiedades del acero inoxidable que son útiles en la práctica de la ortodoncia para que los ortodoncistas se beneficien de este notable material.

Palabras clave: acero inoxidable, alambres de ortodoncia, austenítico, brackets de ortodoncia.

Aço inoxidável: fatos significativos para o ortodontista praticante

Resumo. O aço inoxidável é um dos materiais mais largamente empregados na ortodontia atual. Os arcos de arame, aparelhos, bandas, ligaduras, tubos, dentre outros aparelhos, são fabricados com diferentes tipos desta liga. A primeira evidencia do uso desta liga no campo da ortodontia remonta a meados da década dos vinte quando foi introduzido um material para fabricar arames. Desde essa altura, essa liga ganhou popularidade dentre os ortodontistas e seu desenvolvimento subsequente levou a ampliar seu uso nas diferentes técnicas de ortodontia da atualidade. Embora estivesse disponível por mais de 80 anos, e apesar do fato de que a maioria dos ortodontistas utilizam esse material diariamente, ainda existe um desconhecimento sobre os princípios básicos, composição e propriedades deste material por parte destes profissionais. Portanto, o escopo desta revisão da literatura é discutir as principais características e propriedades do aço inoxidável que são benéficas na prática da ortodontia para que os ortodontistas se beneficiem deste notável material.

Palavras-chave: aço inoxidável, arames de ortodontia, austenita, aparelhos de ortodontia.

Introduction

Stainless steel has many uses in orthodontics for the fabrication of brackets, archwires, bands, ligatures, among other appliances [1]. Stainless steel is an alloy composed of iron and carbon that contains chromium, nickel, and other elements that impart the property of resisting corrosion [2]. There are many different stainless steel alloys in the market, some of which are useful in orthodontics due to their properties.

The three main groups are austenitic, martensitic, and ferritic. Alloys used in orthodontics come from the austenitic type, being 18/8 (18% chromium, 8% nickel, 0.2% carbon and traces of other stabilizing elements) the most widely used [2]. The widespread use of stainless steel in the medical and dental fields resides in different factors, but one of the most important features is its corrosion resistance. This property comes from the addition of chromium to the iron-carbon alloy. This base metal is highly reactive and forms a passive film [3]. This film of chromic oxide resists further attacks from the environment, thus preventing corrosion [4]. Around 11% chromium is necessary to produce corrosion resistance in pure iron, and the proportion increases with the addition of carbon to form the alloy. Passivation may be influenced by different factors such as alloy composition, heat treatment, surface condition, stress, and the environment in which the alloy is placed [5].

In current orthodontic practice, professionals use stainless steel in many appliances for the various techniques. However, many of these professionals lack the proper knowledge an orthodontist should have about a material that is used on a daily basis and, hence, do not take advantage of all the remarkable properties stainless steel alloys offer.

Therefore, the main objectives of this paper are to review the literature on stainless steel, as a biomaterial, in orthodontics and to discuss the composition, types, main characteristics, and properties that may be useful for the orthodontic practitioner to take advantage of an exceptional material. Its biomechanical considerations are beyond the scope of this review.

A brief history

Stainless steel was first introduced by Brearly of Sheffield in 1912 for the rifling of gun barrels. Brearly recommended it for cutlery and the new alloy was employed by Mayer and Company on behalf of the otolaryngologist Heath of London in 1916. He was, apparently, the first to use non-rusting steel instruments. By 1925 many manufacturers offered stainless steel as a more expensive alternative to nickel-plated steel for the fabrication of instruments, and by 1939 nickel-plating had been abandoned by many makers [6].

The history of stainless steels in orthodontics starts back in the early 1930s. By that time, gold alloys were the first choice for the fabrication of wires [7], bands, clasps, ligatures, and spurs [8, 9]. The development of new alloys was benefited by the fact that gold prices were high, which rendered these appliances very expensive, although the controversy between gold and other alloys continued for some decades to come [9]. The "stainless" property of this material was first reported by Monnartz around 1900-1910, although Dumas, Guillet, and Portevin manufactured it before that time in France. During World War I, the Germans developed an austenitic stainless steel, the British a martensitic type, and the Americans a ferritic alloy. Dr. Lucien de Coster was experimenting with "rustless" steel in the mid-1920s in Belgium, while Carman, Walsh, and Bell, among others, were experimenting with this material and cobalt-chromium alloys in the west and southwest. Ernest Friel started using stainless steel bands in 1935.

Orthodontic wires made of stainless steel started to be used in the 1920s and wire manufacturing processes improved the properties and allowed the fabrication of different wire shapes, which in time convinced the skeptical orthodontic practitioners of that time [10]. A few years later, Begg began to use round stainless steel wires and, early in the 1940s, he partnered with Wilcox to make a different type of stainless steel wire: Australian stainless steel. However, stainless steel was not completely accepted until a few decades later. Archie Brusse (founder of Rocky Mountain Metal Products) presented a table clinic on the first complete stainless steel system at the American Society of Orthodontics by 1933. By 1950, the 300 series type were used for most orthodontic materials [11] Nonetheless, the controversy between gold and stainless steel went on during the following decades until it finished in the 1960s, when gold was definitively abandoned in favor of the latter [9].

Types of stainless steel

There are five types of stainless steel alloys depending on their microstructure and chemical composition: ferritic, martensitic, austenitic, duplex (austenitic-ferritic), and precipitation-hardening [12].

Ferritic stainless steel

The American Iron and Steel Institute (AISI) defines these alloys as 400 series [13]. This type of alloy contains between 12% and 29% of chromium and very low amounts of nickel (<2%). Ferritic stainless steels are the most inexpensive due to their low nickel content. They are magnetic, ductile, corrosion resistant, and cannot be heat-treated [13]. However, due to their poor weldability and workability, their use in dentistry is limited. The most representative type of ferritic alloys is AISI 430, which contains approximately 17% chromium [14].

Martensitic stainless steel

They also share the 400 series with ferritic alloys. They can be heat-treated and possess high strength and hardness, which render them suitable for manufacturing surgical instruments. However, their corrosion resistance is low and may be further reduced after heat treatment. Ductility may also be reduced after such treatment [13]. Carbon content ranges from 0.15% to 1%, and chromium content from 12% to 18%. The alloys used to manufacture cutlery and blades are known as AISI 420 and 440 types [14].

Austenitic stainless steel

Austenitic stainless steels are the most commonly used for the fabrication of orthodontic brackets [15] and wires [13, 16] and they are also the most popular members of the stainless steel family [14]. The austenitic structure is created when the alloy is heated at 912°C or higher [17]. Nickel is added to stabilize the austenitic phase (face centered cubic crystal structure) at room temperature [4, 13, 14, 18] in the AISI 300 series. The minimum amount of nickel needed to stabilize the austenitic structure is around 8%. This structure is particularly tough and ductile [19].

AISI 302 type is a basic alloy that contains 17% to 19% chromium, 8% to 10% nickel, and 0.15% carbon. AISI 304 type has a similar composition, with 18% to 20% chromium, 8% to 12% nickel, and a maximum of 0.08% carbon content. These alloys are known as *18/8* stainless steel due to their chromium and nickel content, respectively [13, 20]. A small amount of molybdenum to improve pitting corrosion resistance was added to the 18/8 alloy and it became known as 316 type. Then, the carbon content was further reduced to a maximum amount of 0.03% for improving corrosion resistance and minimizing sensitization. This alloy was known as 316L type (L stands for low carbon content) [18]. 304L contains 18% to 20% chromium, 8% to 10% nickel, <0.03% carbon and small amounts of manganese and silicon [21]. There are other types of austenitic stainless steels, but they are not used in orthodontics and, therefore, will not be included in this article.

Austenitic stainless steels possess excellent corrosion resistance and good formability, weldability [14], ductility and wear resistance [15]. However, these alloys cannot be heat-treated for their hardening because solid-solid transitions occur below the temperature at which atomic diffusions are possible, so they are suitable for applications that do not require heat hardening, such as wires and noncutting instruments, among others [4]. Austenitic alloys are also susceptible to intergranular corrosion and stress-corrosion cracking [22].

Austenitic stainless steels low-nickel content 200 series were developed during the 1930s due to nickel scarcity and high prices. Nickel content is reduced and manganese and nitrogen are added to maintain the austenitic structure, but low amounts of nickel are still present in these alloys. The amount of chromium is also reduced; therefore, the corrosion resistance of 200 series is lower than the standard 300 series [19, 23]. Although these alloys are less expensive than standard 300 series, they are not reported in dentistry [13].

Duplex stainless steel

This alloy's microstructure is composed of a mixture of austenitic and delta-ferritic phases [24, 25]. Chromium content is high (18% to 26%) and nickel content is low (4% to 7%). Most grades contain 2% to 3% molybdenum. The most common grade is AISI 2205 [24].

Duplex stainless steels have high weldability, higher tensile and yield strengths than austenitic or ferritic stainless steels, high toughness [24, 26], are harder than austenitic types and more ductile than ferritic ones and, due to the presence of the austenitic phase, its corrosion resistance is good [25]. In fact, duplex alloys show better resistance to intergranular corrosion and uniform corrosion than austenitic types [22].

Precipitation-hardening stainless steel

The use of this type of alloy has developed since 1946 [27]. It is composed of 15.50% to 17.50% chromium, 3% to 5% nickel, 0.07% carbon, 3% to 5% copper and lower amounts of manganese, silicon, phosphorus, and sulfur [28]. AISI 630, also known as 17-4 PH, is a precipitation hardenable martensitic alloy that has a wide range of applications, including the medical and dental fields [29]. This semiaustenitic stainless steel is highly ductile, can be hardened by the transformation of austenite to martensite [27], has as good as or better corrosion resistance than type 304 [22] and strength, although it is difficult to be machined due to its high hardness [29].

A summary of the composition of stainless steel alloys is given in table 1.

Some orthodontic applications

Super stainless steels

Despite the fact that austenitic stainless steels are the most widely used alloys for orthodontic applications, there are concerns among orthodontists about allergic reactions caused by nickel. In addition, the need for alloys with higher corrosion resistance, higher strength, and improved formability is increasing among professionals. Therefore, a super austenitic stainless steel, known as SR-50A, has been reported as having localized corrosion resistance similar to that of titanium alloys because the passive film is enhanced by the synergistic effect of high concentrations of nitrogen (0.331%) and molybdenum (6.77%) [21, 30]. This alloy has been used experimentally for manufacturing orthodontic brackets and wires with very promising results [21, 30, 31].

Table 1. Chemical composition and AISI grades of some stainless steel alloys

Alloy/Element	AISI grades	C %	CR %	NI %	MO %	MN %	S %	P %	SI %
Ferritic	4xx Series	0.12	12-29	<2		1	<0.03	<0.04	<1
Martensitic	4xx series	0.15-1	12-18	>0.75		<1	<0.03	<0.04	<1
Austenitic	3xx series	0.02-0.05	17-20	8-12	2 (316-316L)	<2	<0.015	<0.04	<1
Duplex	2205	<0.03	18-26	4.5-6.5	2.5-3.5	<2	<0.02	<0.03	<1
Precipitation-hardening	630 (17-4)	0.07	15.5-17.5	3-5	0.06	1.5	0.02	0.04	0.7

Source: Compiled by the authors [8, 18, 25, 32]

Orthodontic brackets

Most manufacturers of orthodontic products use different stainless steel alloys for the fabrication of the numerous brackets they offer. Austenitic stainless steel, such as AISI 304L and 316L, remains as the first choice for the manufacturing of brackets [21]. However, orthodontic brackets are also manufactured using alternative stainless steel alloys, such as 17-4 PH stainless steel [32] and 2205 alloy [25].

Orthodontic mini implants

Although most mini implants or screws used as anchorage devices in the orthodontic field are made of titanium alloys due to this metal's outstanding characteristics [33], stainless steel is still used by one manufacturer [34]. They claim that the mini implant made of surgical grade stainless steel can be easily removed once that action has been performed since this material will not induce osseointegration, which is advantageous because a second surgical procedure will not be necessary.

Orthodontic wires

According to Nikolai, the word "wire" in the orthodontic setting "likely first brings to mind the arch wire, spanning mesiodistal distances between tooth crowns and arguably the principal component of active, fixed-appliance therapy" [10]. Orthodontic wires are used to move teeth with light continuous forces to correct their positions [10, 35, 36]. Most orthodontic wires are fabricated from types 302 and 304 18/8 austenitic alloys [8]. Other types of alloys, however, have been used, such as the Australian stainless steel alloy. It was developed by Begg and Wilcox, who were seeking a light and flexible alloy with high resiliency and toughness to be used as a wire in the newly developed Begg technique [35, 37]. These wires are available in sizes ranging from 0.012" to 0.024" round wire and as regular, regular+, special, special+, premium, premium+, and supreme grades according to their resiliency, which increases from regular to supreme [38].

Pelsue et al. found that Australian wires have a rough, irregular, and porous surface, and these features increase as wire grades increase. This alloy is a 18/8 type, and the manufacturer does not specify the amount of carbon, although these authors state that the carbon content is at least ten times higher than the standard value, which accounts for these surface characteristics. They also found that Australian stainless steel is harder and more brittle than traditional stainless steel, which may pose a problem during orthodontic mechanics. These properties are also associated with high carbon content [37].

Important facts

Passivation

As mentioned above, passivation is the formation of a transparent, insoluble film on the surface of stainless steel alloys that is stabilized by chromium through chrome oxide [17]. If the continuity of this film is broken by different processes, such as welding or mechanical working, it will reform naturally within a very short period of time [2]. This phenomenon is fundamental because it provides stainless steel with its extraordinary corrosion resistance property [2-5], which is of paramount importance in orthodontics.

Corrosion and elemental release

Corrosion of orthodontic stainless steel may be caused by saliva, since it contains bacteria, viruses, yeast, and fungi and their products [39]. Several authors have evaluated the corrosion resistance of stainless steel in orthodontic wires and brackets [40-43] and have found that this alloy shows corrosion potential in different media, including the oral environment. House et al. [44], in their review article, summarize corrosion types as follows:

Uniform attack. It is the most common form, affecting all metals. The metal undergoes a redox reaction with the surrounding environment.

Pitting and crevice corrosion. It is formed on the surface since wires and brackets are not perfectly smooth. Pits and crevices may harbor plaque-forming microorganisms. Crevice corrosion may also occur in removable appliances when wires or components of expansion screws enter the acrylic.

Galvanic corrosion. This type occurs when two metals are placed together in an electrolyte, such as wires and brackets made of different alloys in the oral cavity [45].

Intergranular corrosion. As discussed below, stainless steel is particularly susceptible to this form of corrosion during brazing and welding (see sensitization).

Fretting corrosion. It takes place in areas of metal contact that are subject to load, as the archwire/bracket-slot interface.

Corrosion fatigue. This type of corrosion occurs when metals are subject to cyclic stresses. The phenomenon is accelerated if the alloy is in a corrosive medium, for instance, when archwires are left in the oral cavity for long periods under load.

Microbiologically-influenced corrosion. It may occur due to the fact that microorganisms and their by-products can affect metals in two ways: first, some species absorb and metabolize metal from alloys, which leads to corrosion. Second, they can alter environmental conditions (e.g. by increasing local acidity levels), making them more favorable to cause corrosion of metals [44].

Alloys used in dentistry in general, and orthodontics in particular, are highly biocompatible, but it is important to consider that elemental release and corrosion occur regardless of type of composition. Nonetheless, the amount of corrosion and elemental release vary drastically among alloys. This elemental release is influenced by the composition of the alloy. Nickel, zinc and copper have a higher tendency to be released due to the electronic structure of the elements at the atomic level and the phase structure of the alloy [46]. Kim and Johnson [42] assessed the susceptibility of different orthodontic alloys to corrosion and found that corrosion occurred readily in stainless steel and some Ni-Ti alloys.

Nickel is a composing metal of many alloys used in orthodontics, such as nickel-titanium and stainless steel, among others. This metal increases the strength, ductility and resistance to general corrosion, as well as to crevice corrosion and erosion [17]. Many researches have been carrying out to assess the possible negative side effects that this metal could bring about to oral tissues in orthodontics [47-52]. Nickel hypersensitivity has been associated with the use of dental devices, such as orthodontic appliances. Van Hoogstraten et al. [53] investigated the combination of ear piercing and the use of orthodontic devices in patients who were 35 years old or younger and they found that when dental brackets are worn before ear piercing, nickel allergy was significantly reduced. However, when brackets are worn after ear piercing, suppression was not observed, but rather a small increase in nickel allergy. Similar associations are reported by Mortz et al. [54] and Todd and Burrows [55] in their researches. They also reported a higher prevalence of nickel allergy in girls, which is also reported in other papers [56, 57]. Although orthodontic alloys are considered safe, there are case reports on nickel hypersensitivity caused by orthodontic appliances, both from stainless steel and nickel-titanium alloys [50, 58-60]. Common intra-oral signs include redness, swelling, and soreness of the oral mucosa and palate, gingiva and lips [59]. Extra-oral manifestations, such as dermatitis, may also be observed [58].

As already mentioned, chromium is the element that aids stainless steel passivation phenomenon. Together with nickel, chromium is a well-known allergen, although nickel is a stronger one [48]. Chromium release has been assessed both *in vitro* and *in vivo*. Sfondrini et al. [1] found that chromium is released in higher quantities from new stainless steel brackets than from recycled ones and that release increased at pH 4.2 in their *in vitro* investigation. Matos de Souza and Macedo de Menezes [61] found that chromium and nickel ion concentrations increased ten minutes after placement of orthodontic appliances in the mouth in their *in vivo* investigation.

Behavior of stainless steel in fluoride solutions

Orthodontic treatment may initiate damage to teeth or supporting structures in some cases [62]. In order to avoid these damages, orthodontists often recommend fluoride mouthwashes to be used by their patients during the active period of treatment [63, 64]. However, fluoride solutions may be detrimental for orthodontic alloys, including stainless steel. Walker et al. [65] used 1.1% acidulated phosphate fluoride and 1.1% sodium fluoride neutral agent to evaluate the effect of such products on loading and unloading mechanical properties of beta titanium and stainless steel. They found that both alloys exhibited qualitative surface topography changes and a significant decrease in unloading mechanical properties, which might extend orthodontic treatment time. Kaneko et al. [66] subjected four different orthodontic wire alloys to 2.0% acidulated phosphate fluoride to examine the degradation in performance after short-term immersion in this solution. They concluded that stainless steel was slightly affected by hydrogen absorption, whereas nickel-titanium and beta titanium were more affected. Kao et al. [67] investigated the toxicity of cells treated with different extracts from stainless steel orthodontic wires corroded in acidified phosphate fluoride solutions. They concluded that the corrosive solution of stainless steel extracts in acidified NaF artificial saliva can cause U2OS cell toxicity and advised to remove wires when applying fluoride or to change the wires after fluoridation to prevent toxicity.

Heat treatment

It was already mentioned that austenitic stainless steels are the widest used for the manufacturing of orthodontic wires, especially AISI 304 type.

Austenitic alloys may be classified in two groups depending on the stability of austenite under deformation: those that do not form martensite and those that do. x-ray diffraction analyses have shown that austenitic orthodontic wires undergo martensitic transformation after cold work [8, 13]. Thus, after this transformation, diverse zones of different hardness are created in the arch. To overcome this inconvenient, annealing is done to homogenize the mechanical properties of the wire and relieve stress [68]. Several authors have proposed temperatures and times to accomplish this. Backofen and Gales [69] proposed 500°F (260°C) for 20 minutes or 750°F and 820°F (398.8°C and 437.7°C) for ten minutes. Funk [70] states that 850°F (454.4°C) for three minutes is the best approach. Ingerslev [71] proposes 350-375°C for four minutes, while De Biasi et al. [68] suggest 450°C for three minutes. Heat treatment leads to improved elastic strength [69]. However, this treatment cannot be performed at temperatures over 650°C [8]. Ingerslev recommends not to heat 18/8 stainless steel at 400°C or more because doing so will reduce corrosion resistance [71].

Sensitization of austenitic stainless steels

This phenomenon occurs when austenitic stainless steel alloys are heated. Brantley states that this phenomenon occurs when the alloy is between 400°C and 900°C [8], while Gonzalez and Santos indicate that it takes place between 500°C and 800°C [72]. Carbon forms chromium carbide that precipitates on the austenite grain boundaries. Because chromium is tied up as carbide, those regions adjacent to the boundaries will be depleted of chromium, so corrosion may take place [73]. Chromium diffuses more slowly than carbon, so there is not enough time for chromium to diffuse to the carbide from all over the grains. Consequently, chromium content lowers to below 13% in the region near grain boundaries. This is the critical value for required corrosion resistance [74]. Therefore, "the free-hand soldering of stainless steel orthodontic appliances should be performed rapidly with a well-controlled torch and the use of a flux" [8].

Cold welding

Moving teeth with fixed appliances produces a relative motion between the contacting surfaces of brackets and archwires [75]. Friction is defined as the force opposing the movement of two objects in direct contact to each other and its direction is tangent to a common interface between both surfaces [76]. This concept must be kept in mind in orthodontics since it has an influence on the rate of tooth movement [77]. Friction is influenced by many factors, including, but not limited to, the type of bracket and wire materials [76, 78]. Researchers have found that the combination between stainless steel wires and brackets display the lowest friction coefficients among regular materials used to manufacture brackets and wires [75, 76, 78], while the combination between beta-titanium wire and stainless steel bracket showed much higher levels of friction [78]. This topic is important to orthodontists because a phenomenon known as cold welding (the result of adhesion between both materials) may have implications in the length of orthodontic treatment [79]. Kusy et al. [80] report that adhesion between these two materials may occur due to the fact that the titanium-rich oxide layer in the beta-titanium wire breaks down, reacts, adheres, and breaks away, resulting in a "stick-slip" phenomenon.

Coating of orthodontic stainless steel

Stainless steel orthodontic wires, brackets, and ligatures can be coated with different substances to accomplish diverse objectives. Increasing biocompatibility is one of these goals since corrosion products released by this alloy to the surrounding tissues may be harmful for the host [81]. Therefore, several approaches and materials have been used by different authors to enhance its biocompatibility, such as the application of ceramic coatings to orthodontic stainless steel wires [81], the use of silver-platinum coatings [82], or the coating of orthodontic brackets with polytetrafluoroethylene (PTFE) [83]. The decrease in friction between wires and brackets is another important factor in orthodontics since a reduction in friction might shorten the treatment time and improve anchorage control [84]. Several authors have investigated the effect that different coatings have on the sliding resistance of stainless steel orthodontic wires, brackets, and ligatures against such material and others, like ceramics and elastomers [84-87]. Their findings show that certain combinations of materials display less friction, while others do not exhibit a significant difference. Therefore, coating of orthodontic materials remains a topic to be further investigated.

Different techniques have been proposed to coat orthodontic appliances. These processes may be divided into thermal and chemical procedures. Thermal procedures include Thermal Phase Separation (TPS) and Vapor Deposition (VD). Chemical processes may be classified in electrodeposition, electrophoresis, and sol-gel [81].

Conclusion

Stainless steel is still one of the widest used materials in the orthodontic field. Different types of this alloy are available in the market to achieve diverse purposes. Austenitic stainless steel is the preferred alloy for the manufacturing of wires, brackets, bands, and mini-implants due to its good corrosion resistance and notable mechanical properties. However, this material is not perfect and some drawbacks can be found, such as allergies, sensitization, and cold welding. Nonetheless, this alloy has been part of the orthodontic armamentarium for many decades and is an active part of today's orthodontic practice. Therefore, a better knowledge of this material is of paramount importance for the orthodontic practitioner.

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