

# SELF-LIGATING SYSTEM: ADVANTAGES AND DISADVANTAGES

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## ABSTRACT

The present study presents theoretical considerations regarding the self-ligating system with the purpose of demonstrating its advantages and disadvantages. A scientific research in books and scientific articles was developed, guided by the deductive method. The data indicate that the self-ligating system provides greater effectiveness of orthodontic therapy, optimization of clinical treatment time, reduced number of consultations, reduction of chair time, faster and more effective results, facilitation to make alignment and leveling, better performance of sliding biomechanics, Elimination of the use of elastic bandages, low friction, low friction between the bracket and the arch, use of less intense forces, minimization of exodontias efficacy to perform expansions, comfort for the patient, improvement of oral hygiene and preservation of periodontal health. As disadvantages, the self-ligating system provides greater discomfort to remove and insert arches, constant clip fracture, labial discomfort, more likely occlusal influences that can lead to problems at the end of treatment and treatment expense that is costlier for the patient. It is the professional's job to properly recommend the type of self-ligating bracket to be used, according to the diagnosis, planning, mechanics used, whether or not the teeth are extracted, and whether or not it requires friction during mechanics.

**KEYWORDS:** Advantages, bracket, disadvantages, self-ligating.

## 1. INTRODUCTION

The effectiveness of orthodontic therapy should be based on an adequate diagnosis and a satisfactory biological response of the patient to the biomechanics recommended by the orthodontist, in which the selection of the apparatuses configures relevant function<sup>1</sup>. The self-ligating brackets have been gaining prominence for orthodontic treatments due to the advantages provided by them that end up providing greater effectiveness of orthodontic therapy<sup>2</sup>.

Cases of malocclusion especially those of severe crowding that require premolar extraction and initial canine retraction can be treated with the self-ligating system<sup>3</sup>. This system, however, is more suitable for crowding cases whose treatment does not establish dental extraction,

because in these cases, low friction promotes the crowding solution with shorter treatment time<sup>4</sup>. The uses of self-ligating brackets have become popular worldwide and one of its advantages is to eliminate the use of elastic bandages to brackets<sup>5</sup>.

The objective of this study was to present theoretical considerations regarding the self-ligating system with the objective of demonstrating its advantages and disadvantages.

## 2. MATERIAL AND METHODS

A scientific research in scientific books and articles was developed, guided by the deductive method, to carry out analyzes and findings regarding the self-ligating system according to the perception of different authors. We present data from theoretical studies and case reports suggestive of the proposed problem in order to discern the perspectives conferred on the advantages and disadvantages of the self-ligating system for orthodontic treatments.

## 3. LITERATURE REVIEW

Cacciafesta *et al.* (2006)<sup>6</sup> measured and compared the level of resistance to friction between the self-ligating stainless-steel brackets, the polycarbonate brackets of self-ligating and conventional stainless-steel brackets. It was observed that self-ligating stainless-steel brackets provided the advantage of generating less static and kinetic friction forces when compared to conventional stainless-steel brackets and self-ligating polycarbonate brackets, which did not show any significant difference between them. Titanium beta strands provided higher resistance to friction if compared to stainless steel wires and nickel titanium wires. There was no significant difference between nickel titanium and stainless-steel wires. As the yarn size increased, the brackets showed higher static and kinetic friction forces. In cases of patients with aesthetic needs, self-ligating polycarbonate brackets are a possibility for conventional stainless-steel brackets and ceramic ones.

Maltagliati (2007)<sup>7</sup> considered that a disadvantage of passive self-ligating brackets is that they can interrupt the

torque control at the finalization stage, this being necessary to use an anchor or an elastic, in order to increase the friction between the wire and the bracket. Another disadvantage is that the treatment becomes costlier for the patient.

Pandis *et al.* (2007)<sup>8</sup> have disclosed that the advantages of self-ligating brackets include the elimination of elastomers, elimination of cross-contamination caused by bandages, lack of elastic forces, lower risk of demineralization of dental enamel due to elimination of plaque accumulation sites, reduction of friction in sliding mechanics and the application of less intense forces.

Miles (2007)<sup>9</sup> compared the effectiveness and comfort between self-ligating brackets and conventional brackets along the initial alignment. The sample had 60 patients in which the two types of brackets were placed. When placing the first arch, patients felt greater discomfort with conventional brackets, however they felt the opposite when placed the second arch. This discomfort may have been motivated by the greater difficulty of placing the second arch in the self-ligating brackets, due to the greater dental unevenness at the end of the use of the arch initially placed. When comparing the brackets with respect to the effectiveness, in the initial wires, the self-ligating brackets were not more effective than the conventional brackets, however, when placing the second arc 0.016x0.025, the self-ligating brackets were more efficient.

Alpern (2008)<sup>10</sup> performed an evaluation of the time and effectiveness of orthodontic treatment and confronted patients who received treatment with a self-ligating bracket and conventional bracket. As advantages, the self-ligating bracket, besides shortening the treatment time, offered more comfort to the patient and also provided stable results.

Macedo (2008)<sup>11</sup> developed a bibliographic study with the intention of evaluating the advantages of orthodontic treatment performed with self-ligating brackets. The author found that the self-ligating brackets are very favorable to the daily orthodontic clinic, because they can shorten the treatment time, offer a different orthodontic treatment, shorten the patient's waiting time in the chair, improve periodontal health, provide satisfactory results to achieve a biomechanical treatment of orthodontic treatment with a lower level of strength, to provide a better performance of the sliding biomechanics and to provide better management in the clinical procedures.

Fernandes *et al.* (2008)<sup>12</sup> conducted a study on self-bonding brackets. It was observed that these were designed to optimize the time of clinical treatment. Due to the fact that no lashing is used, surface friction is reduced at the bracket / orthodontic interface, thus, less force is required to constitute tooth movement, thereby obtaining a faster and more efficient way to the treatment. Due to the aesthetic demand on the part of the patients, the self-ligating brackets are now made of polycarbonate, this

bracket system is a good option for the clinical routine of these cases. This type of brackets allows to hold the orthodontic strand passively and dispenses any type of external bonding agent, allowing less permanence of the superficial friction. Thus, a faster and more comfortable treatment for the patient can be achieved, and less intense orthodontic forces can be achieved. Aesthetic benefits can also be obtained when the self-ligating brackets are made of polycarbonate.

Harradine (2008)<sup>13</sup> reported that the main advantages of the self-ligating system involve the possibility of expressively decreasing treatment time and providing satisfactory anchoring, especially in cases that prescribe larger dental movements, even though they are incomplete, there is evidence that there is, through this system, more effective treatment, good robustness and ease of use.

Lenza (2008)<sup>14</sup> inquired about the widespread use of self-ligating brackets for all patients, regardless of crowding level, to the detriment of posttreatment stability. For the author, there may be transverse expansion, this raises doubts, since, the question is to value the stability for a long period.

Jakob (2008)<sup>15</sup> pointed out that one of the advantages of self-bonding brackets is the flexibility of the clip used in their materials, which make the forces less intense and therefore avoid harmful effects, this given to dissipate part of the applied force and provide better control of movements, such as angulation, torque and rotation.

Maltagliati (2009)<sup>16</sup> stated that the system of self-ligating brackets proposes to treat cases of dental crowding, without the previous reach of space with extraction, surgery, orthopedic disjunction and wear. For the author, it is possible to make alignment and leveling easier with the self-ligating system, so as to produce mechanically desirable effects in a shorter period of time.

Castro (2009)<sup>17</sup> emphasized that self-ligating brackets have not yet demonstrated mechanical superiority over conventional systems, in order to justify their higher cost. Most of the information concerning self-linked systems comes from corporate promotional material, clinical case reports and congresses. The credibility of the product in relation to the manufacturer's prescription is therefore in doubt. Adopt the use of self-ligating brackets does not suggest be the best approach, since most studies provided with randomly selected clinical samples should be undertaken. These studies should address the mechanics and (essential) advantages of each system. It is also necessary to analyze the stability of the concluding treatments of the use of self-ligating brackets in the long term, since it is not possible to change paradigms without scientific evidence capable of fully grounding a posture.

Fleming *et al.* (2009)<sup>34</sup> avaliaram se na percepção dos pacientes haveria dor uma semana depois de instalar os aparelhos autoligados e convencionais e para retirar os arcos ortodônticos. Observaram-se que o tipo de bráquete

não exerceu influência na experiência de dor na primeira semana após ter instalado o aparelho, entretanto ocorreu maior desconforto para remover e inserir arcos com o aparelho autoligado.

Ikeda *et al.* (2009)<sup>19</sup> affirm that among the advantages of the self-ligating system it is possible to emphasize reduction of the time of the orthodontic treatment; reduction of the patient's time in the chair; periodontal health; low level of strength in orthodontic treatment biomechanics; performance in sliding biomechanics and satisfactory finishing results.

Ehsani *et al.* (2009)<sup>20</sup> carried out a systematic review based on 19 articles to evaluate the amount of frictional resistance between conventional and self-ligating *in vitro* brackets. When compared to conventional brackets, self-fastening brackets determine less friction if there is a combination of round arches of small diameter and if there is no angulation and/ or torque, arcing with optimum alignment. No satisfactory evidence was found to corroborate the low friction of self-ligating brackets when compared to conventional ones when using rectangular arches, in the presence of angulation and/ or torque, in cases of major malocclusion. Most of the studies analyzed agree that the friction of self-ligating brackets and conventional brackets tends to increase with the arc gauge.

Miles (2009)<sup>33</sup> observed that self-ligating brackets have advantages, such as less friction, provide less time for bow insertion and allow treatment to be faster with less pain.

Barbosa (2010)<sup>20</sup> considered that using only brackets with the characteristics of self-ligatures cannot guarantee the orthodontist the biomechanical action of low friction. The author mentions the Damon system, which offers low friction and can go beyond the design of the bracket, however, it is not suggested that the Damon system is the only one capable of delivering great results. The low friction of this system has led to the publication of numerous periodical articles in the area. There are several articles that warn of the increase of friction with the use of multicolored ligatures to tie the bows, requiring greater force to make the movement of the teeth and, consequently, there is a greater loss of anchorage, a fact that tends to increase the time of treatment. Some advantages in using self-powered brackets, involves efficiency by reducing friction, rapid biological responses, reduction of chair time, low friction and control of movements; reduction of appointments and treatment time; minimizing exodontia and simplifying mechanics.

Ferreira *et al.* (2010)<sup>21</sup> consider that self-fastening brackets are efficient and with several advantages over conventional appliances. In orthodontic treatment, the pain has a greater relation with the sequence of yarns used and the resorption has more relation with the duration of the treatment, the type of support or collage of the system used. Friction is not the most salient fact to be estimated

in self-attached brackets. The binding phenomenon (torques to eliminate the gap between the bracket and the wire) does not appear to be compromised by self-ligatures, and self-attaching brackets could shorten chair time to remove wire. Further studies are needed to evaluate evidence that treatment with self-bonding brackets may have advantages for space closure and faster leveling, are more effective at performing expansions and reducing exodontia. There is insufficient evidence to support that self-ligating devices offer more advantages than the conventional apparatus, or vice versa. Also, they do not attribute specific advantages in what is mentioned to the subjective experience of pain. There is no satisfactory evidence that the treatment is efficient with self-ligating brackets.

Burrow (2010)<sup>22</sup> sought to compare the percentages of canine retraction with self-ligating brackets with conventional brackets. The self-ligating bracket was used in the canine on one side and a conventional bracket on the other in 43 patients who needed to perform upper premolar extraction. The retraction of the teeth was done with stainless steel wire 0, 018, using a mean Sentalloy retraction force (150 g). The mean movement for 28 days for the self-ligating bracket was 0.9 mm and for the conventional bracket of 1.10 mm on average. The self-ligating system offered faster results because the differences between the conventional and self-ligating brackets were statistically significant. According to the author, the percentage of retraction is faster when using the conventional bracket, possibly due to the lower width of the self-attached brackets.

Trevisi (2011)<sup>23</sup> emphasized that the SmartClip™ system does not necessarily show the classic friction, which allows the application of low force levels, requiring less anchoring in the alignment, leveling and closing of spaces. The classic friction can be de-activated by means of elastic and metallic ties used to support the bow mounted in the channel of conventional brackets. Failure to use the conventional bracket tends to decrease the established strength levels of the treatment to avoid unexpected movements of the teeth, allowing the glide to occur more easily in the various biomechanical stages of orthodontic treatment. Another great advantage of self-ligating brackets is that they can be used in all cases of malocclusion, inclusively, severe crowding that requires the extraction of canines.

Sathleri *et al.* (2011)<sup>24</sup> observed that self-ligating brackets are associated with treatments that present greater speed and effectiveness. Unlike traditional brackets, self-ligating brackets do not bind. There is considerable literature confirming that self-fastening brackets significantly reduce the friction resistance along the sliding mechanics.

It is suggested that the possibility of restricting extractions and of performing maxillary expansion with the use

of this system. Although self-ligating devices have an impact on Orthodontics, it is relevant to know its true advantages, considering all factors fundamental to its mechanics of action. It is necessary to explore studies to evaluate the effectiveness of the expansion determined by this modality of treatment to avoid ineffective treatments.

Pacheco *et al.* (2011)<sup>26</sup> have asserted that, in general, the self-ligating brackets can decrease the friction with the thread, and therefore an advantageous clinical probability is evaluated to minimize the unexpected effects of the friction analyzed in the conventional brackets, when using the sliding mechanics.

Ferrari (2011)<sup>27</sup> clarified that several advantages are conferred to self-ligating brackets, among them the patient's greater comfort, shortened chair time, the use of less intense forces, less risk of injuring the periodontal tissues, greater ease of hygiene, control of bacterial plaque and, especially, reduction of friction with the orthodontic wires, a fact that can collaborate to reduce the time of treatment.

Johanssona *et al.* (2012)<sup>28</sup> emphasized that self-ligating brackets decrease the total time of treatment, the number of visits and improve the efficiency of orthodontic treatment.

Godinho *et al.* (2013)<sup>29</sup> report that self-ligating brackets have several advantages, such as greater expansion of dental arches, greater anchorage conservation, less proclination of anterior teeth, less friction, less need for extractions, shorter treatment and consultation times, easier oral hygiene and greater comfort for the patient. However, they demonstrate some disadvantages, such as higher cost, constant clip fracture, greater profile and, consequently, lip discomfort, greater probability of occlusal influences that generate problems at the end of the treatment.

Accorsi (2013)<sup>30</sup> said that due to the low friction, some advantages are conferred to the mechanics of the self-ligating brackets. These are evidenced, especially in the reduction of the time of treatment, possibility to increase the comfort and hygiene for the patients and, reduction of time of chair for the patient and professional. Extractions and surgical expansions can be reduced, improving slip mechanics, reducing anchorage needs. Even with these advantages, self-ligating brackets need to be cared for, and professionals must be provisioned with constant learning in training courses, thus increasing the knowledge of the advantages of these new methods, thus reducing the risks of an inappropriate use of self-ligating systems.

Macedo (2013)<sup>31</sup> argues that self-ligating brackets have the advantage of being able to perform low friction movement, provide better aesthetic and functional results, have brands and models of Brazilian manufacturers that have more intelligible prices.

Martins Neto *et al.* (2014)<sup>32</sup> described the characteristics, importance and advantages of self-

ligature in Orthodontics. The studies analyzed indicate that the self-ligating bracket system is an innovative method oriented to reach the needs of the patients, in order to respect the physiological limits of each case, combine speed, reduce treatment time and still provide better aesthetic and functional results.

The main advantage attributed to this system is the optimization of the time of clinical care, given the low friction between the bracket and the wire, especially at the beginning of the treatment, for not using moorings, a reduction of the superficial friction is noticed. Also, the applied forces are less absorbent to institute tooth movement, which can happen quickly and effectively. For the authors, the advantages of the self-ligating brackets include more satisfactory aesthetic results, optimization of clinical care time and use of less intense forces.

#### 4. DISCUSSION

Self-ligating brackets offer many advantages, such as providing better aesthetics, better management of clinical procedures, ensuring complete arch support, high friction when desired, easy elastic chain connection, easy bow change, no unexpected movement of teeth, have a lower risk of root apical resorption, apply biological forces to the teeth without compromising vascular supply in the periodontal membrane and achieve better finishing results<sup>10,11,13,19,20,23,24,30</sup>.

The orthodontic treatment performed with the self-ligating brackets can reduce the number of consultations<sup>10,11,13,19,20,28,29</sup>, collaborate to decrease chair time<sup>11,19,20,27</sup>, can deliver faster and more effective results<sup>12,22</sup>.

Other advantages of self-attaching brackets include ease of alignment and leveling, improved performance of sliding biomechanics, and elimination of the use of elastic bandages<sup>5,7,8,11,16,19,23,24</sup>.

Also with regard to the effectiveness to perform the alignment and leveling in the self-ligating brackets, it was observed that it is possible to facilitate the alignment and leveling with this system, in order to generate mechanically expected effects and in a shorter period of time<sup>1,16,21,22</sup>.

The literature still shows that self-ligating brackets use less intense forces, thereby minimizing the risk of causing injuries to the periodontal tissues, a fact that reduces friction with orthodontic wires, and can help reduce treatment time. It may also reduce the need for surgical extractions and expansions, improve slip mechanics and reduce anchorage needs, providing more satisfactory aesthetic and functional results<sup>12,27,30,32</sup>.

The self-ligating brackets allow to reduce the friction between brackets and wires and, with this, can collaborate to achieve an effective sliding movement applying smaller forces<sup>6,9,12,24</sup>.

Low friction is another advantage of self-ligating system<sup>3,4,6,8,9,16,23,24,26</sup>. Thus, the low friction between the bracket and the arch are significant advantages of the self-ligating system<sup>12,20,27,29,30,31,32</sup>.

Barbosa (2010)<sup>20</sup> warns, however, that only the use of self-attached brackets cannot guarantee the orthodontist the biomechanical action of low friction. In fact, the low friction of this system has motivated the publication of a variety of periodical articles in the area and, several of them warn of the increase of friction with the use of multicolored ligatures to tie the arches, this requires greater force to move the teeth, therefore, there is a greater loss of anchorage, and the tendency is to increase the treatment time.

Other important advantages pertaining to self-ligating brá-quete involve better oral hygiene of the patient, better periodontal health and greater comfort for the patient, ease of use and satisfactory anchoring, especially in cases that require larger dental movements, with improved orthodontic treatment efficiency<sup>1,2,10,13,16,24,28</sup>.

Lenza (2008)<sup>14</sup>, Godinho *et al.* (2013)<sup>29</sup> agree on the question of the self-ligating system allowing greater possibility of occlusal influences that determine problems at the end of the treatment.

Other disadvantages of the self-ligating system are greater possibility of breaking brackets and hooks, cause of discomfort in the patient's lips with the bracket hook closure and for its high cost, self-ligating system are not used on a large scale. Fleming *et al.* (2009)<sup>34</sup> also confirmed in his study the occurrence of greater discomfort to remove and insert bows with the self-ligating device.

Camargo *et al.* (2007)<sup>1</sup>; Maltagliati (2009)<sup>16</sup>; Ferreira *et al.* (2010)<sup>21</sup>, were unanimous about the need for more studies to evaluate evidence to ensure that treatment with self-bonded brackets can cooperate to close the space and leveling faster and that they are more efficient to perform expansions and reduce exodontia.

Authors like Castro (2009)<sup>17,18</sup>; Ferreira *et al.* (2010)<sup>21</sup>; Sathleri *et al.* (2011)<sup>24</sup> e Accorsi (2013)<sup>30</sup> also agree that there is a need to propose further studies corroborating the essential advantages and disadvantages of the self-ligating system.

Thus, the choice between a self-ligating bracket or a conventional bracket should consider aspects that transcend the ease of acquisition of the product, the manufacturing quality and the clinical (dis) advantages of each one, seeking to further analyze the best treatment for each clinical case<sup>10,11,13,19,20,23,24,30</sup>.

#### 4. CONCLUSION

The self-ligating system presents different advantages, such as greater effectiveness of orthodontic therapy; optimization of clinical treatment time; reduced number of consultations; reduction of chair time; faster and more effective results; facilitating alignment and leveling; better

performance of sliding biomechanics; elimination of the use of elastic bandages; low friction; low friction between the bracket and the bow; use of less intense forces; minimization of extractions; effectiveness to perform expansions; comfort for the patient; improvement of oral hygiene; and, preservation of periodontal health. The disadvantages of the self-ligating system are greater discomfort to remove and insert bows; interruption of the control in the finishing phase due to the lack of elastic bonds that increase the friction between the wire and the bracket; constant clip fracture; discomfort; greater probability of occlusal influences that can generate problems at the end of the treatment; and, treatment expense that is more costly for the patient.

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