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CERAMIC BRACES IN ORTHODONTICS, AESTHETICS, AND EFFICIENCY IN ONE DEVICE

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Abstract

Ceramic braces are an aesthetic alternative to metal braces, being frequently used in orthodontics for patients who want a more discreet treatment. They are made of a translucent or colored material similar to natural teeth, providing a pleasing visual appearance and increased compatibility with soft tissues. Among the main advantages are superior aesthetics, increased comfort, and lack of metals, making it an ideal solution for people allergic to orthodontic alloys. However, ceramic braces also have some disadvantages, such as increased brittleness, higher friction that can prolong the treatment, and a higher cost compared to metal braces. Also, the elastic ligatures used can undergo color changes over time, affecting the aesthetic appearance of the device. In terms of efficiency, metal braces remain superior due to increased strength and reduced friction, which allows for faster treatment. The choice between ceramic and metal braces depends on the patient's needs, aesthetic priorities, and orthodontist recommendations. This review provides a detailed analysis of the advantages and limitations of ceramic braces, contributing to an informed decision on their use in orthodontic treatments.

Keywords: Ceramic braces, orthodontics, dental aesthetics, orthodontic braces, orthodontic treatment, metal braces.

Introduction

Ceramic braces are an aesthetic alternative to metal braces, being increasingly used in orthodontics due to the discretion offered. They are made of a translucent or opaque ceramic material, which is close to the natural color of the teeth, reducing the visual impact of the orthodontic appliance. Although the main goal of any orthodontic treatment is to correct the malocclusion and achieve a functional occlusion, many patients, especially adults, want a solution that is as invisible as possible. In this context, ceramic braces offer an optimal combination of aesthetics and efficiency [1-3].

A major advantage of these braces is their discreet appearance, which makes them preferred by patients working in fields where image is important. Unlike metal braces, ceramic braces do not reflect light and do not create a strong contrast on the surface of the teeth. In addition, the smooth surface of the ceramic material ensures increased comfort, reducing irritation in the oral mucosa [2-4].

However, these benefits come with certain limitations. Ceramic braces are more brittle than metal ones and have a lower mechanical strength, which makes them more prone to fractures, especially in patients with strong masticatory forces. Also, the higher coefficient of friction between the orthodontic arch and the brace slot can prolong the duration of the

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treatment, requiring more frequent adjustments. Another aspect to consider is their higher cost compared to metal braces, due to the complex manufacturing process and the materials used [2-5].

In terms of maintenance, although the ceramic braces themselves do not stain, the elastic ligatures used to fix the arch can undergo color changes over time, especially in contact with pigmented foods or smoking. This aspect can affect the aesthetics of the device during the treatment, requiring frequent replacement of the ligatures to maintain a clean and discreet appearance [1,3-5].

The purpose of this review is to analyze the advantages and disadvantages of ceramic breeches, comparing them with existing alternatives to provide a clear picture of their effectiveness and limitations. Through this analysis, patients and orthodontic specialists can make informed decisions about choosing the most appropriate type of braces, taking into account both the aesthetic and functional aspects of the treatment.

Advantages of ceramic braces

Ceramic braces (Fig. 1 and 2) are preferred by patients looking for an effective yet discreet orthodontic solution. Their main advantage is superior aesthetics, thanks to the translucent material or being colored in shades similar to natural teeth. Unlike metal braces, ceramic braces do not reflect light strongly and do not create a visible contrast, being almost imperceptible in photos or social interactions. This makes them a popular choice among adults and people who work in fields where image matters [3-5].

Another advantage is increased comfort. The ceramic material has a smooth surface, reducing the risk of irritation to the oral mucosa. Although any braces can cause initial discomfort, ceramic braces are gentler on soft tissues compared to metal braces. Additionally, they do not contain metals, making them an ideal option for patients who are allergic to nickel or other alloys used in orthodontics [4-6].

From a functional point of view, ceramic braces offer moderate resistance, sufficient for most orthodontic cases. Although they are more brittle than metallic ones, technological advances have significantly improved their durability. Thus, the state-of-the-art braces are more compact and resistant to fractures, and can be successfully used in the correction of various types of malocclusions [4-6].

Fig. 1. Front view of an orthodontic appliance with ceramic braces. The architecture of the appliance is observed, including the orthodontic arch and elastic ligatures, which contribute to dental alignment. Ceramic braces offer an improved aesthetic appearance, being less visible compared to metal ones.

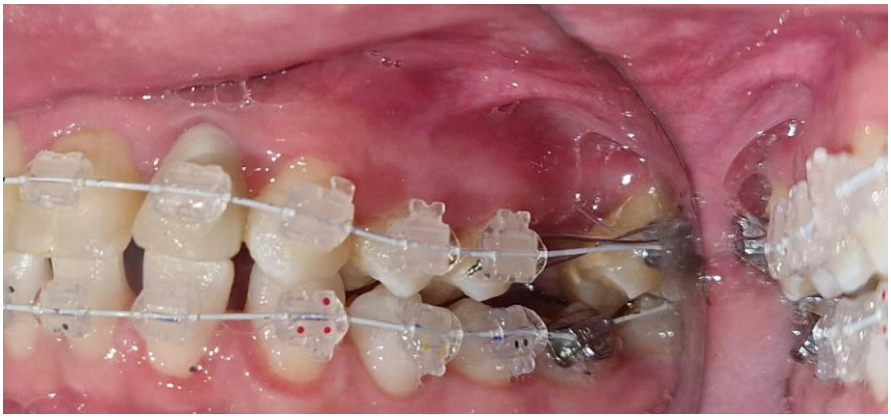

Fig. 2. Side view of an orthodontic appliance with ceramic braces.

Another important feature is compatibility with modern treatments. Ceramic braces are compatible with thermodynamic orthodontic arches and advanced dental movement control techniques, providing effective results without compromising aesthetics. In addition, they can be combined with transparent or white elastic bandages for an even visual effect [4-6].

In terms of adaptability, ceramic braces can be used in both the upper and lower arches, being a versatile alternative for patients who want a compromise between efficiency and aesthetics. They are suitable for moderate and complex cases, provided that the patient follows the doctor's recommendations to avoid excessive forces that could lead to fracturing of the braces [2,4-6].

Ceramic braces are an aesthetic, comfortable, and effective solution for tooth alignment, being a viable alternative to traditional metal braces. However, it is important for patients to be informed about their characteristics and limitations to make a suitable choice according to their orthodontic needs [4-7].

Disadvantages of ceramic braces

Although ceramic braces offer significant aesthetic advantages, they also have a number of disadvantages that must be considered. One of the most important is increased fragility. Unlike metal braces, ceramic braces are more brittle and susceptible to fractures, especially in patients with strong bites or who practice contact sports. If a ceramic brace breaks, replacing it can be expensive and extend the duration of treatment [4-7].

Another problematic aspect is the greater friction between the arch and the brace, which can slow down tooth movement. The ceramic material does not allow as effective a sliding of the orthodontic arch as in the case of metal ones, which can lead to a longer treatment. In some cases, orthodontists need to use special springs to compensate for this limitation, which may incur additional costs [5-7].

The high cost is another important disadvantage. Ceramic braces are significantly more expensive than metal ones, both because of the materials used and the more complex manufacturing process. In addition to the higher initial price, in case of damage, patients must also bear the replacement costs, which can considerably increase the investment during orthodontic treatment [5-10].

Although the ceramic material itself does not stain, the elastic ligatures used to fix the spring can become colored over time due to pigmented foods (coffee, tea, red wine, curry) or smoking. This can affect the aesthetic appearance of the appliance, requiring frequent ligature

replacements to maintain a clean appearance. An alternative would be to use braces with a self-ligating system, but they are even more expensive [6-10].

Another disadvantage is the slightly larger size of ceramic braces compared to metal ones. Due to the more fragile material, they are manufactured a little more voluminous to increase strength, which can create additional discomfort for some patients, especially in the first weeks of treatment [8-12].

Table 1. The table compares the advantages and disadvantages of ceramic braces used in orthodontics. The "Feature" column lists the essential features, "Advantages" shows the benefits of this type of brace, and "Disadvantages" highlights the limitations. The comparison highlights the trade-offs between aesthetics, comfort, efficiency, and cost, helping patients make an informed decision about orthodontic treatment [8-16].

Feature	Advantages	Disadvantages
Aesthetics	Discreet appearance, translucent or tooth-colored material	Elastic ligatures may stain over time due to food and smoking
Comfort	Smooth surface, less irritating to the oral mucosa	Slightly larger size, possible initial discomfort
Durability	Moderate durability, improved by modern technologies	More fragile than metal brackets, prone to fractures
Treatment duration	Can provide effective results in standard cases	Higher friction may prolong treatment duration
Cost	More affordable than invisible solutions (e.g., orthodontic aligners)	More expensive than metal brackets
Friction between the archwire and the bracket	Can be optimized using special archwires	A higher friction coefficient may require additional adjustments
Care and maintenance	Brackets themselves do not stain, maintaining an aesthetic look	Frequent replacement of ligatures is needed to prevent discoloration
Size	Designed more robustly to improve strength	Bulkier compared to metal brackets
Allergy compatibility	Metal-free, suitable for patients allergic to nickel	Not as mechanically resistant in cases of strong bites

Comparison of efficiency with metal braces

Ceramic and metal braces have the same operating principle, but there are significant differences in terms of treatment efficiency. Metal braces are considered more resistant and durable, having a higher tolerance to the forces applied by the orthodontic arch. Ceramic ones, on the other hand, are more fragile, being able to fracture under excessive pressure, which requires increased attention during chewing [8-16].

Another important factor is the coefficient of friction. Ceramic braces have a rougher surface than metal ones, which causes greater friction between the spring and the slot. This increased resistance to movement can slow down the tooth alignment process and prolong the duration of treatment, especially in cases that require significant tooth displacements. To compensate for this, orthodontists use special springs with a coating that reduces friction, but this can involve additional costs [16-19].

As for the discomfort felt by the patient, ceramic braces are smoother and less irritating to soft tissues, but their slightly larger size can initially cause more discomfort than metal ones. On the other hand, metal braces, although smaller and more mechanically efficient, can cause irritation on the cheeks and lips more frequently [17-19].

Although from an aesthetic point of view, ceramic braces are superior, the effectiveness of the treatment is slightly lower compared to metal braces. Patients who want a faster and more durable treatment may prefer metal braces, while those who prioritize visual discretion can opt for the ceramic version, assuming any compromises [8,17-19].

Conclusions

Ceramic braces are an excellent aesthetic option for patients who want discreet braces, but they have both advantages and limitations. Among the main benefits are the almost invisible appearance, increased comfort, and compatibility with patients allergic to metals. However, increased frailty, greater friction that can extend the duration of treatment, and higher cost are important aspects to consider.

Compared to metal braces, ceramic braces offer a compromise between aesthetics and efficiency, being recommended especially for adult patients or those concerned about the visual appearance of the orthodontic appliance. On the other hand, in cases that require high orthodontic forces or extensive tooth movements, metal braces remain the more effective choice due to their durability and low coefficient of friction.

To maintain the aesthetic appearance of ceramic braces, patients should avoid pigmented foods and smoking, as elastic ligatures can undergo staining over time. Also, following regular orthodontist appointments and maintaining rigorous oral hygiene are essential for effective and uncomplicated treatment.

Finally, the choice between ceramic and metal braces should be based on the patient's priorities, the type of malocclusion, and the orthodontist's recommendations. Those who emphasize discretion can opt for ceramic braces, assuming any limitations, while patients who want maximum efficiency and faster treatment can choose the metal version.

References

1. Birnie D. *Ceramic brackets*. **Br J Orthod.** 1990, 17:71–74. doi: 10.1179/bjo.17.1.71
2. Al-Ibrahim HM, Hajeer MY, Burhan AS, Sultan K, Ajaj MA, Mahaini L. *The efficacy of accelerating orthodontic tooth movement by combining self-ligating brackets with one or more acceleration methods: a systematic review.* **Cureus**. 2022, 14:0. doi: 10.7759/cureus.32879
3. Labh S. *Lingual biomechanics, case selection and success*. **J Indian Orthod Soc**. 2016, 50:10–20
4. Keith O, Kusy RP, Whitley JQ. *Zirconia brackets: an evaluation of morphology and coefficients of friction.* **Am J Orthod Dentofacial Orthop**. 1994, 106:605–614. doi: 10.1016/S0889-5406(94)70085-0
5. Maijer R, Smith DC. *Time savings with self-ligating brackets*. **J Clin Orthod**. 1990, 24:29–31
6. Oh KT, Choo SU, Kim KM, Kim KN. *A stainless steel bracket for orthodontic application.* **Eur J Orthod**. 2005, 27:237–244. doi: 10.1093/ejo/cji005
7. Viazis AD, Cavanaugh G, Bevis RR. Bond strength of ceramic brackets under shear stress: an in vitro report. **Am J Orthod Dentofac Orthop**. 1990, 98:214–221. doi: 10.1016/S0889-5406(05)81598-7
8. Kusy RP. *Orthodontic biomaterials: from the past to the present*. **Angle Orthod.** 2002,72:501–512. doi: 10.1043/0003-3219(2002)072<0501:OBFTPT>2.0.CO;2

9. Maki K, Futaki K, Tanabe S, Takahashi M, Ichikawa Y, Yamaguchi T. *Applicative characteristics of a new zirconia bracket with multiple slots.* **Int J Dent.** 2016, 2016:4348325. doi: 10.1155/2016/4348325
10. Berger JL. *The influence of the speed bracket's self-ligating design on force levels in tooth movement: a comparative in vitro study.* **Am J Orthod Dentofacial Orthop**. 1990, 97:219–228. doi: 10.1016/S0889-5406(05)80055-1
11. Griffiths HS, Sherriff M, Ireland AJ. *Resistance to sliding with 3 types of elastomeric modules. Resistance to sliding with 3 types of elastomeric modules*. **Am J Orthod Dentofacial Orthop.** 2005, 127:670–675. doi: 10.1016/j.ajodo.2004.01.025
12. Al-Ibrahim HM, Hajeer MY, Alkhouri I, Zinah E. *Leveling and alignment time and the periodontal status in patients with severe upper crowding treated by corticotomy-assisted self-ligating brackets in comparison with conventional or self-ligating brackets only: a 3-arm randomized controlled clinical trial.* **J World Fed Orthod.** 2022, 11:3–11. doi: 10.1016/j.ejwf.2021.09.002.
13. Dirie AR, Hajeer MY, Dabbas J, Al-Ibrahim HM. *Evaluation of sandblasting with acid etching versus acid etching alone in the preparation of enamel for rebonding orthodontic brackets: an in vitro study and a randomized controlled trial*. **J World Fed Orthod.** 2021, 10:3–8. doi: 10.1016/j.ejwf.2020.12.001
14. Al-Ibrahim HM, Hajeer MY, Burhan AS, Haj Hamed Y, Alkhouri I, Zinah E. *Assessment of dentoalveolar changes following leveling and alignment of severely crowded upper anterior teeth using self-ligating brackets alone or with flapless Piezocision compared to traditional brackets: a randomized controlled clinical trial.* **Cureus.** 2023, 15:0. doi: 10.7759/cureus.35733.
15. Buckley J. Lingual orthodontics: an illustrated review with the incognito fully customised appliance. **J Ir Dent Assoc**. 2012, 58:149–155
16. Ryu HS, Bae IH, Lee KG, Hwang HS, Lee KH, Koh JT, Cho JH. *Antibacterial effect of silver-platinum coating for orthodontic appliances.* **Angle Orthod.** 2012, 82:151–157. doi: 10.2319/021411-111.1
17. Henao SP, Kusy RP. *Frictional evaluations of dental typodont models using four self-ligating designs and a conventional design*. **Angle Orthod.** 2005, 75:75–85. doi: 10.1043/0003-3219(2005)075<0075:FEODTM>2.0.CO;2
18. Kim TK, Kim KD, Baek SH. *Comparison of frictional forces during the initial leveling stage in various combinations of self-ligating brackets and archwires with a custom-designed typodont system*. **Am J Orthod Dentofacial Orthop**. 2008, 133:187–124. doi: 10.1016/j.ajodo.2007.08.013
19. Budd S, Daskalogiannakis J, Tompson BD. *A study of the frictional characteristics of four commercially available self-ligating bracket systems.* **Eur J Orthod**. 2008, 30:645–653. doi: 10.1093/ejo/cjn058

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