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Auxiliaries of Clear Aligner Therapy

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Abstract

Background: clear Aligner Therapy (CAT) has transformed orthodontic treatment by offering a comfortable, discreet, and removable alternative to traditional braces. Initially designed for minor tooth movements, but has expanded its reach thanks to the integration of various auxiliaries and advancements in biomechanics. The objective of this paper is to review the most essential auxiliaries that enhance its efficacy, control, and predictability.
Methods: an overall search was carried out over multiple databases, including PubMed, Google Scholar, and SciELO, to identify literature on auxiliaries used in orthodontic clear aligner therapy published between 2000 and 2025. In addition, pertinent chapters from leading publications on invisible orthodontics discussing clear aligner therapy were included.
Results: to share the input collected from the scientific literature, the authors developed the following sections to structure the content: definition and types of auxiliaries, location of auxiliaries, function of auxiliaries, comparison between types and the role of each auxiliary.
Also, there are subdivisions in some sections to be explained more deeply in that subject matter.
Conclusion: CAT has been improved by using auxiliaries for better results with less relapse, like brackets, power ridges, elastics, TADs, and MARPE. The orthodontist selects the appropriate type according to each case to get better anchorage, especially in complicated orthodontic cases.

Keywords: Clear Aligner Therapy, Attachments, Power Ridge, Bite Ramp, Pontic, TADs, MARPE, Elastic Hooks, Aligner Chewies.

1. Introduction

From the day of the invention of the Tooth Positioner (TP Orthodontics) in 1944, removable appliances have been used until the discovery and invention of clear aligners, which have been implemented for cases that require mild to moderate orthodontic tooth movements [1]. So, as a definition, Therapy with clear aligners is a way of aligning teeth that uses transparent, plastic aligners that are custom-made. Aligners can give a slight and gentle amount of pressure to the teeth that will start moving the teeth in a gradual amount into the correct position. It also has the benefits of being nearly invisible, also it it can be as comfortable as possible to wear, and can be removed for eating and brushing, allowing it to be utilized to treat a variety of orthodontic difficulties [2]. Auxiliaries and biomechanical advancements have allowed aligners to accomplish more complex movements, which were previously limited to minor corrections. Adjuncts like bite ramps, pressure points, power ridges, elastics, interproximal reduction (IPR), temporary anchorage devices (TADs), and expanders increase the range of movements that aligners can accomplish, as highlighted by Weir et al. [1]. As a summary, clear aligner therapy can be an effective method in giving the patients a

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great smile while being invisible, comfortable, and easy to clean, maintaining oral hygiene with the help of auxiliaries suitable for each case.

2. Attachments

Martz first presented the idea of attachments in 1988. He explained a detachable tool for positioning teeth and suggested composite buttons that were cemented to provide components that an aligner could "hook onto" to enable motions [3]. Because of its aesthetic appeal, simplicity of clinical manipulation and micromechanical bonding to etched enamel tooth structures, composite resin is employed as an attachment [4]. The attachments can be directly applied to the tooth surface, using composite material, enabling the aligner to apply the stress on the tooth surface more effectively [5], [6]. Attachments ensure retention while also enabling intricate tooth movements, including translation [7]. By employing finite element (FE) techniques, the impact of attachments on the maxillary dentition's closing diastema was examined by Yokoi et al. [8], and they concluded that attachments were necessary to achieve physical mobility. Attachments have little effect on tipping moment or tensile forces, according to Goto et al. [9]. The active surface, passive surface, and base are the three components that make up attachments.

The particular portion of the attachment that will make contact with the aligner's plastic in order to produce the required force vectors and ensuing tooth motions is known as the active or functional surface. Stated otherwise, the aligner's pushing forces are received by this portion of the attachment. Effective force vectors frequently have a direction perpendicular to the active surface because the orientation of the active surface dictates the direction of force systems [10]. The passive surface is the portion of the attachment that remains in the buccal face and serves to stabilize the attachment.it can help aligner fitting, or at least make it easier Since the surface roughness of the materials used for attachments today wears down with time, a low-volume passive surface could be counterproductive because it would increase the chance of fracture, wear, or detachment of the attachment, reducing its durability [11].

The portion of the attachment that secures to the tooth crown is called the base, last but not least [12]. The bevel is another idea related to attachment terminology. An attachment's bevel is an oblique incision at the edge or tips that results in the attachment's pointed end to create a level, angled surface. Fit problems with rectangular attachments led to the suggestion to use a bevel. Because the angle of emergence at the interface between the tooth and the attachment is a right angle, this attachment design necessitates that the aligner be fully seated on the attachment. Because the gap in the aligner only needs to cross the corner of the attachment's bevel, adding a bevel makes the aligner adaptation more user-friendly [13].

2.1 Attachment size and location

An attachment with a large active surface area (both in length and thickness) maximizes the contact region of the aligner to produce pushing forces [14]. In order to extrude a mandibular canine, Tian et al. used finite element analysis to test vertical and horizontal rectangular attachment designs in various sizes and positions. They found that while increasing attachment size increased the force on the periodontal ligament, which enhanced the extrusion effect, it also increased tilting in other directions [15]. It is advised to use a standard size of 3 mm for both width and length for horizontal and vertical attachments, respectively. The larger attachment was able to generate more force, but not only in the targeted direction but also in other axes that caused unfavorable movements, according to a study by Costa et al, [16]. The attachment's placement impacts the best point of force

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application and aligner retention. Biomechanical principles suggest that moving the force action away from the tooth's center of resistance results in an increased tilting moment [10].

Attachments at the gingival margin of the tooth exhibit less tilting compared to those near the incisal edge or occlusal surface. Initially, it was thought that attachments along the incisal margin would be more effective in retention [17]. As aligners become less flexible at this level, research indicates that attachments close [18], [19]. The gingival margin helps retain appliances. The attachment should be at least 1.5 mm from the aligner's gingival edge to avoid unwanted plastic bending [17]. When using clear aligner therapy, orthodontists may have the opportunity to optimize treatment plans while shortening the treatment time, and the results will be more precise and predictable by having a superior knowledge and understanding of the biomechanics of various attachment designs [20].

2.2 Types of attachments

Derakhshan advocated classifying attachments based on their association with virtual planning software. A real attachment is a composite attachment that is bonded onto the patient's teeth. Virtual attachments are virtual representations of attachments or shapes formed in the aligner that are not physically cemented onto the patient's teeth. A window attachment creates room around a tooth to allow for movement or isolate it from adjacent teeth [12]. Attachments can be categorized into two groups: conventional attachments and optimized attachments [21].

2.2.1 Conventional attachments

Conventional attachments are considered a passive attachment that facilitates aligner engagement and bonding with the teeth. They serve as a handle for the aligners to move teeth. They can be put in by clinicians during design and include standard shapes [22]. Conventional attachment is the most popular option for space closure and aligner retention [23]. There are three types of conventional attachments:

- **Ellipsoid attachments**

The ellipsoid form lacks a defined active surface, making it the least powerful attachment type. However, they may only be used on specific tooth surfaces, such as the lingual side of mandibular second molars or peg-shaped lateral incisors [24]. Different attachment forms and materials that impact aligner adherence have been investigated by Dasy et al. [19]. Ellipsoidal attachments had been reported not to significantly modify the force required to remove the aligner, hence supporting its retention [17].

- **Rectangular attachments**

Rectangular attachments can be inserted in a vertical or horizontal way, as shown in Fig. 1, usually in the center of dental crowns. However, they can be changed to any position based on the intended tooth movement. Horizontal rectangular attachments help improve and increase the retention of the aligner on short crowns and assist in the management of root position, such as buccal torquing of molar roots. Also, they are often used in the management of advancement of mandible. In unilateral crossbite, they can be used on the side with no crossbite to provide anchorage and support for the repair of posterior crossbite. When software cannot place optimized attachments, vertical rectangular attachments are applied for control of the root, such as mandibular incisors, in circumstances where one lower incisor is extracted [22].

A study found that employing vertical rectangular attachments for arch distalization reduced mesiodistal tilting of the tooth during movement. This study found that vertical attachments had the

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most adverse effects of the attachments, such as torque, tipping, and intrusive force. Flat active surfaces on premolar teeth led to optimum performance during de-rotation [25].

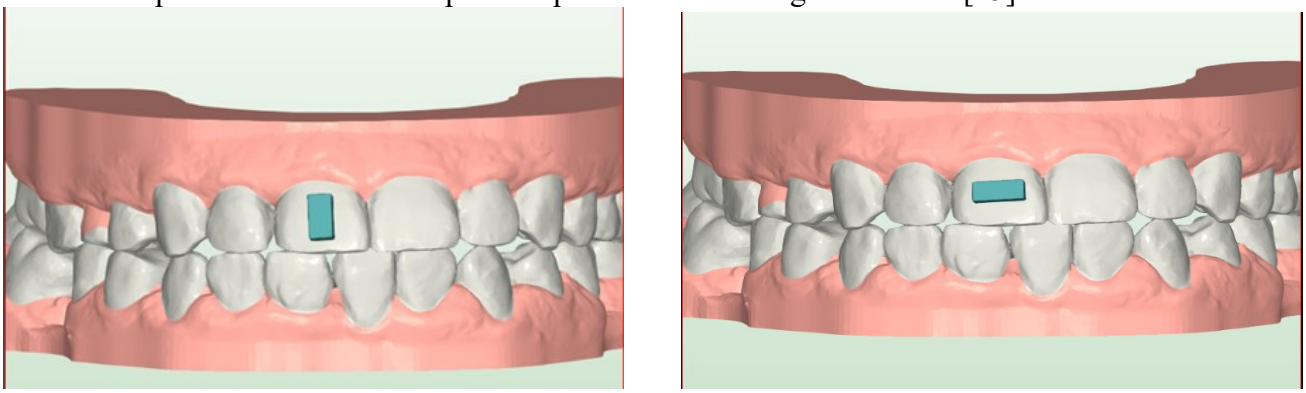

Fig. 1 Rectangular attachment(on the left side, horizontal rectangular and on the right, vertical rectangular attachment.

- **Bevelled attachments**

Rectangular attachments are bevelled in a horizontal and vertical direction (Fig 2) in order to reinforce and increase aligner retention. For the purpose of extruding a tooth, a horizontal attachment directed towards the gingiva works best. Also, for inserting a tooth, an attachment that is horizontal and occlusally bevelled tends to be preferable. An attachment that is bevelled vertically enables rotating movements [23]. The bevel's flat surface provides a suitable platform for exerting aligner force, resulting in successful tooth movement [5]. A realization of Costa et al. [16]. After observing the force effect that is generated by three attachment designs during maxillary central incisor extrusion in three planes (X, Y, and Z). His research reached that a bevelled attachment figure increased the extrusion ability of the aligner while reducing tipping variations in relation to that extrusion.

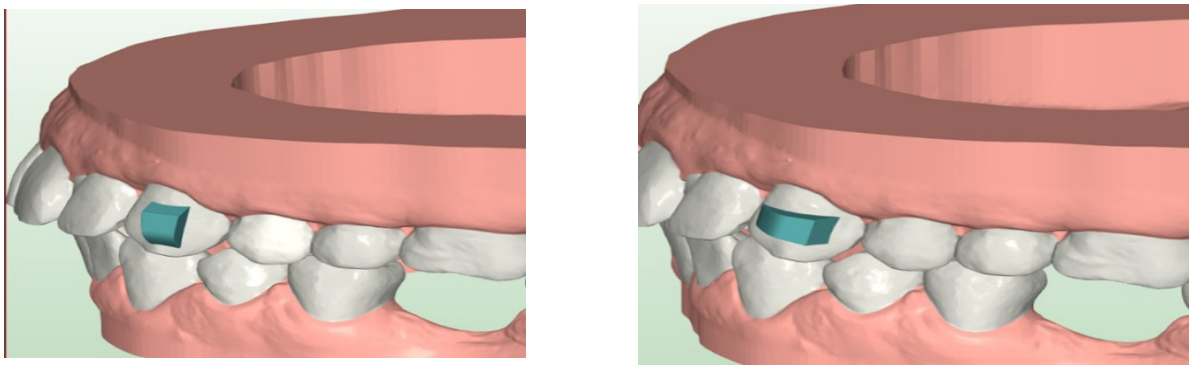

Fig. 2 bevelled attachment (on the left a vertical bevelled attachment and on the right a horizontal bevelled attachment.

2.2.2 Optimized attachment

Invisalign offers optimized attachments as part of its Smart Force features, as shown in Fig. 3. These attachments are unique because the Align Technology algorithm determines their shape, size, and position [26]. Research that is held by Karras et al. Found that optimized attachments are more powerful in the rotation of teeth, whereas other attachments, like conventional attachments, are a lot much efficient in extruding the teeth[24]. A study used finite element analysis to examine how attachments affect stress distribution during canine distalization. A comparison between two optimized ellipsoid attachment aligners to an aligner with no attachments. This experiment found that canines with attachments moved in approximately parallel patterns. Models lacking attachments exhibited uncontrolled angular movement, with minimal movement in the root area of the tooth [27].

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Fig. 3 optimized attachment.

3. Power ridge

Power ridges are elevated elements on aligners that are intended to increase the force applied to particular teeth and boost the effectiveness of movement, as shown in Fig. 4. According to Dai et al. [28], power ridges with aligners greatly increase the speed at which teeth move, and Weir et al. [1] mentioned that they also helped with alignment, shortened treatment times, and increased patient satisfaction. Studies have revealed a propensity for central incisors to lose torque and extrude in extraction cases, especially in first premolar extraction. Double power ridges can produce lingual root torque, while a single power ridge cannot, as shown in Fig. 5. Additionally, they noticed that displacement values rise with increasing ridge depth, indicating that staged mechanics—tilting retraction followed by root control—might maximize results [29]. Furthermore, without appropriate anchorage, power ridges by themselves might not be enough, according to clinical evidence. Strong canine attachments like vertical rectangular designs, which support incisor intrusion and lingual root torque during extraction space closure, increase their efficacy [30].

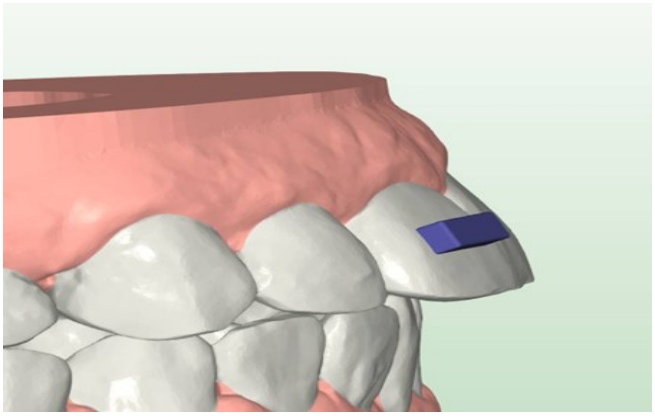

Fig. 4 Power ridge

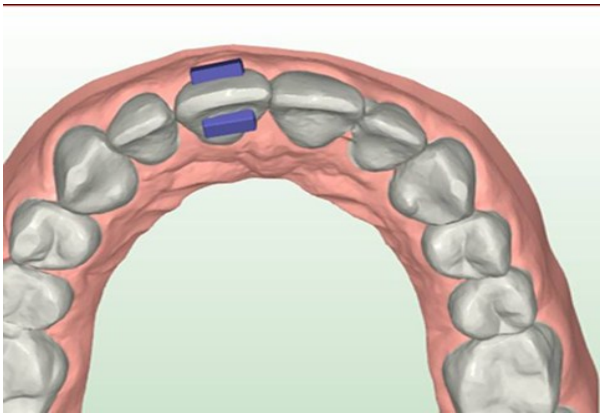

Fig. 5 Double power ridge.

4. Bite ramp

Bite ramps are elevated regions on aligners that are used to adjust the occlusion between the upper and lower teeth by disarticulating the posterior teeth to make extrusion easier and intruding the mandibular anterior teeth [31]. They are typically positioned on the lingual surface of the maxillary incisors, as seen in Fig. 6. The bite ramps should be moved to the canines if maxillary anterior intrusion is desired, which is frequently the case in Class II Division 2 malocclusions. The reason for this is that bite ramps lessen the pressure applied to the maxillary incisors' long axes that require intrusion. When using bite ramps, there is

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less plastic in contact with the incisors' cingula, and there is minimal surface area ready for the intended intrusion force vectors. Bite ramps also restrict the expression of torque for the same reason [31]. One of the hardest conditions to treat with clear aligners is a deep bite, which is known as an extravagant amount of vertical overlap between the incisors. Depending on incisal display, conventional methods use incisor intrusion, molar extrusion, or a combination of these [32]. The difficulties of correcting a deep bite with aligners alone were highlighted by Kravitz et al. [31]. Who also underline the value of auxiliary devices like bite ramps, elastics, and attachments to enhance force control and retention? Bite ramps can improve results by allowing for controlled proclination, improving anterior intrusion, and providing space for posterior extrusion, despite the limited predictability of aligners [33]. Even with these developments, more study is required to produce more consistent and trustworthy outcomes.

Fig. 6 Bite ramp on maxillary incisor.

5. Pontic

It is prevalent for a patient undergoing aligner treatment to have one or possibly more missing teeth. One of the advantages of using clear aligners is that we can create a pontic to occupy the missing space [1], [34-37]. A pontic is a tooth-shaped substitute that fills the space left by extracted or missing teeth. There is a gap or space in the clear aligner as a result of the aligner not covering a tooth in this area of the patient's mouth. To make this gap look like a tooth, it can be filled or painted. Traditionally, light-cure radiopaque composite is used to create the pontic in 3D printed models. However, creating composite teeth that mimic the structure of genuine teeth without overlapping neighboring teeth calls for a high level of expertise.

This treatment takes a lot of time and is not cost-effective [34]. During orthodontic treatment, pontics provide a number of important advantages. In the first place, they greatly improve aesthetics, which is crucial when anterior teeth are lost. By preserving healthy oral function and space, they also aid in preventing the emergence of aberrant oral habits like tongue thrusting and speech impairment. Additionally, pontics make sure that the missing tooth's precise mesio-distal width is maintained, which is essential for optimal alignment. They make it simpler to match the midline and align with the riding pontic when one incisor is absent unilaterally. Finally, by restoring function and appearance, pontics can significantly enhance the patient's psychosocial well-being [38].

Engaging buccally erupted canines into the aligner can be challenging. Manufacturing restrictions may prevent the inclusion of ectopic canines even if they are registered on the impression or digital scan. In order to allow for canine eruption and alignment, eruption compensation may be incorporated into the aligner, which functions as a virtual pontic

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[39]. In cases of canine impaction, if the impaction is not resolved by extracting the primary canines, more action is necessary. Even though surgical exposure is frequently required, aligner therapy provides a clear benefit in treating these situations. When it comes to managing space and improving aesthetics during canine eruption, pontics are a vital component of aligner-based treatment.

Without interfering with the orthodontic process, pontics are a short-term but efficient way to preserve space and enhance the appearance of the smile on aligner trays [40]. In lower incisor extraction situations as well, it is advisable to request small pontics so that the aligner material can completely engage around the teeth next to the extraction site. In cases where primary canines were extracted and implants were positioned, the primary canines were removed at the same time. Pontic material was used to fill in the patient's primary canines in the final aligner until the implants were fixed [39].

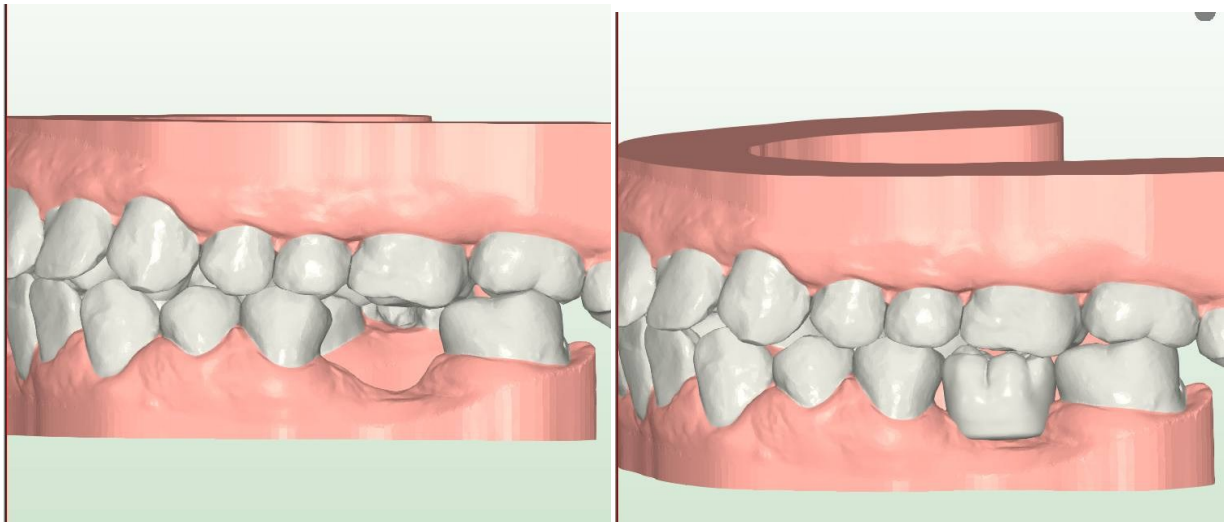

Fig. 7 Before and after adding pontic.

6. Button cut/ Elastic hook

It is often thought that the ability of clear aligners to achieve the best results alone is limited [40]. However, the use of external auxiliary components, such as intermaxillary elastics [41] or temporary skeletal anchorage devices [42], can improve control over tooth movement and enable the proper handling of complex cases, such as extraction space closures [43] or distalizations [44]. It is easier to attach orthodontic elastics to clear aligners by hooks or bonding buttons to specific teeth. The aligners must be seated over these adjuncts by removing portions of the aligner plastic [45]. Precision cuts may be designated as precision cut hooks or button cutouts; these enable the use of intraoral elastics to treat Class II and III malocclusions with different movements of both dental arches. It is also possible to add button cutouts to help with some challenging extrusive tooth movements [39].

The Hole Punch Plier and Tear Drop Plier make this task simple. The Hole Punch pliers make a half-moon cut in the aligner plastic to make the bonding of the button easier, while the Tear Drop pliers make a teardrop-shaped cut at the edge of the aligner, which helps the patient put on elastics [46]. Compared to buttons, class II elastics attached to aligners by precision cutting demonstrated better anchorage control with less tooth displacement and associated stress on PDL and alveolar bone. This is an excellent substitute when extrusion of the upper canines and proclination of the upper incisors are undesirable [45].

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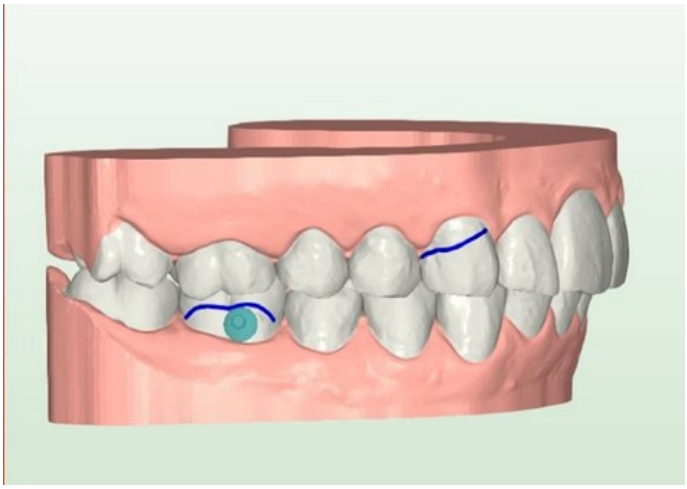

Fig. 8 class II elastics with a button cut on the lower first molar and an elastic hook on the upper canine.

7. Temporary Anchorage Devices

The findings indicate that using minis crews in combination with aligners enhances treatment control, especially when complicated tooth motions such as distalization, extrusion, and intrusion are required. More stability and control over movement are offered by mini crews. There is challenges in this approach, including accurate mini crew alignment and pain. The benefits of aligners in terms of appearance and comfort resulted in a high degree of satisfaction. Further research is required to thoroughly examine the topic in order to enhance therapeutic outcomes [47]. TADs have evolved into a revolutionary tool that addresses issues with achieving precise tooth movements, particularly when using clear aligners. Mini-implants, sometimes referred to as TADs, are tiny titanium screws that are temporarily inserted into the palatal bone [48].

Using TADs leads to teeth moving without causing the unfavorable reciprocal movements that are connected to conventional anchorage techniques. In other cases, aligners are not biomechanically efficient enough to perform these movements correctly, even when they are effective for overall tooth alignment. By allowing the application of additional pressures in certain directions that aligners cannot accomplish on their own, TADs provide aligners with the necessary anchoring to boost their efficacy [49], [50-52]. The combination of TADs and aligners offers a potential method for treating difficult malocclusions without requiring patient participation, which is essential when using aligners [53], [54].

Combining TADs with aligners is useful in complex situations like extrusion, intrusion and correction of deep or open bites. TADs provide a firm anchoring point that can improve orthodontic treatments' efficacy and efficiency [55]. Orthodontic mechanisms that intrude incisors, such as intruding arch wires or TADs, are beneficial for individuals with anterior tooth over eruption [47], [56]. The main treatment option for vertical maxillary excess in previous years was orthognathic surgery; however, incisor and molar intrusion can be accomplished with Temporary Anchorage Devices. When an anterior open bite is present at the same time, it is advised that the posterior teeth intrude more than the anterior teeth [57], [58].

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7.1 The relationship between clear aligners and the biomechanics of temporary skeletal anchoring devices (TSADs)

The total accuracy of tooth movement should be less than 50%; aligner therapy is particularly difficult. Furthermore, “the third rule of physics, which states that there is an equal and opposite reaction to every force action”, makes the anchorage offered by Clear Aligners (CA) crucial. In difficult instances, CA, in conjunction with temporary skeletal anchoring devices (TSADs), has an advantage that increases the range of motion. Interradicular miniscrews offer superior anchorage for incisor intrusion, whereas extra-alveolar miniscrews linked to CA are useful for retracting and intrusion [59]. Root movement (torque movement) is the least predictable movement, whereas the upper and lower dentition [59].

Treating difficult instances with CA requires a deep grasp of biomechanics. However, there are several serious biomechanical drawbacks to using CA, such as patient involvement, anchoring control, and important tooth movement, such as torque tipping, which is the simplest to do. In actuality, CA are really adept at pushing their teeth, but they struggle with pulling [59]. The fact that few orthodontists treat difficult patients with CA regularly, including those with Class II (33%) and Class III (30%) malocclusions, open bite and deep bite (1%) malocclusions, may be explained by these facts. When combined, skeletal anchoring and aligners offer a unique approach to managing anchorage in complex situations involving sagittal problems or even asymmetrical cases.

For example, the anterior teeth will move in opposition when the buccal segment is distalized; intermaxillary elastics and interproximal reduction will still be necessary, Power arms will still be necessary, it will be challenging to close gaps with root movement control, and biomechanics (Newton's third law) side effects will continue [59]. We employ extra-alveolar (E-A) mini-implants as skeletal anchoring auxiliary components to minimize side effects and enhance tooth movement predictability. This lessens biomechanical flaws in CA. To treat malocclusions, the physician can also fasten E-A miniscrews to interradicular TSADs. Clear aligners can be used to fix vertical and sagittal problems, and both miniscrews (interradicular and E-A) can be used to enhance treatment outcomes A. Almeida23 recommends treating vertical issues like deep bite by fixing sagittal obstacles using interradicular TSADs in conjunction with infrazygomatic crest (IZC) miniscrews [59].

8. Miniscrew-Assisted Rapid Palatal Expansion:

Miniscrew-assisted rapid palatal expansion (MARPE) is a good substitute for conventional rapid palatal expansion, especially in adults [60]. Unilateral or bilateral posterior crossbite may be produced from maxillary transverse discrepancy. It is frequently linked to tooth crowding and can be brought on by environmental or hereditary factors. Complications include Class II and III malocclusions, canine impaction, crossbite, TMJ problems, and sleep apnea can result from this issue. Usually, pre-puberty maxillary disjunction is used as a treatment [61], [62]. To separate the midpalatal suture, rapid maxillary expansion devices are frequently utilized. When the midpalatal suture is not completely established, the device indirectly causes it to separate by applying bilateral stresses from the expansion screw to the first upper molars and premolars to the palatal bone.

These techniques are less effective in adults because the developed median palatal suture also promotes dentoalveolar compensation and adverse dental and periodontal outcomes [63]. Historically, the option for these patients was surgically aided rapid palatal expansion [SARPE], but

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patient pain and related risks frequently decreased compliance. A novel therapeutic option for postpubertal patients is MARPE. With a stiff component attached to miniscrews placed into the palate, MARPE can be either bone-borne or tooth-bone-borne. By sending the expansion force directly to the maxillary basal bone, this configuration encourages skeletal growth [64], [65]. Dentoalveolar compensations and adverse effects seem to be less likely with MARPE. It is a simpler method with fewer effects on patient-reported outcomes and lower expenses than SARPE [66], [67]. It has been shown to be possible to include a digital workflow into the conventional analog protocol in MARPE [68].

8.1 Rapid palatal expansion methods with the use of BMX Expander and mini-implants

A common malocclusion that is frequently linked to either a unilateral or bilateral skeletal crossbite is a maxillary transverse deficit. In certain skeletal crossbite instances, appropriate occlusion settings and long-term stability may require more than simply dental extension. In mini-implant-assisted fast palatal expansion approaches, the anchor teeth and mini-implants share the expansion burden. Rapid palatal growth procedures aided by mini-implants. Hybrid Hyrax appliances are those that rely on dental structures and mini-implants for support. A hybrid hyrax, often referred to as a BMX expander, can be used to treat skeletal crossbite in situations where aligners have been used. After the expansion process is complete, the BMX expander can be removed [69], [70].

9. Aligner chewies

Aligner chewies are cotton-roll-shaped styrene copolymer auxiliary products that are intended to enhance tray seating and lessen "aligner lags" [71], [72]. When a new aligner is inserted, it frequently does not fully seat because of programmed movements of up to 0.3 mm. By using Aligner Chewies to eliminate air bubbles from the aligner, we are ensuring a tight fit. If the aligner is not completely seated, the teeth will not be in the desired position. This is known as a "halo effect," where there is a halo-shaped gap between the teeth and the aligner, and it will cause more unseats in the ensuing aligners [72].

Usually, patients are told to focus on areas where seating is incomplete by repeatedly biting on chewies for a few minutes several times a day. Their application lowers the possibility of cumulative misfit across succeeding aligners, improves tracking, and increases force expression [72]. Chewies have been suggested for therapeutic uses in addition to seating, such as controlling anterior open bites by applying intrusive forces to the back of the teeth [73], [74]. By using techniques like sequential intrusion of posterior teeth while maintaining or extruding anterior teeth to achieve bite closure, this method takes advantage of the aligners' natural propensity to create posterior open bites as a result of prolonged occlusal coverage. Chewies can be used as an adjuvant to improve aligner performance and increase the predictability of such mechanics [75], [76]. Table 1 shows the comparison of auxiliary types.

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Table1. Comparing auxiliary types.

Auxiliary types	Biomechanical function
Ellipsoid attachments	Supporting and improving aligner retention
Rectangular attachment	Horizontal rectangular attachments enhance the retention of the aligner on short crowns and assist in the management of root position. Vertical rectangular attachments for arch distalization reduced mesiodistal tilting of the tooth during movement
Bevelled attachment	Reinforce and increase aligner retention Aid in the intrusion and extrusion of teeth
Optimized attachment	Helps in the rotation movement of the teeth
Power ridge	Improve tooth movement efficiency. Extrusion in extraction cases (prevents torque loss). Controls incisor torque.
Bite ramps	Adjust the occlusion between the upper and lower teeth by disarticulating the posterior teeth to make extrusion easier and intruding the mandibular anterior teeth. In Class II Division 2 malocclusions, bite ramps should be moved to the canines so that it help in maxillary anterior intrusion. Force control and retention in deep bite correction. (Bite ramps can improve results by allowing for controlled proclination, improving anterior intrusion, and providing space for posterior extrusion).
Pontic	It acts as a substitute that fills the space left by extracted or missing teeth, thereby preserving function and space and improving esthetics. Incorporated as an eruption compensation in cases of buccally erupted canines.
Buttoncut/ elastic hook	Attach orthodontic elastics to clear aligners to treat Class II and III malocclusions with different movements of both dental arches. It is also possible to add button cutouts to help with some challenging extrusive tooth movements.
TADs	enhances treatment control, especially when complicated tooth motions such as distalization, extrusion, and intrusion are required. More stability and control over movement are offered by miniscrews. Correction of open bites or deep bites.
Aligner chewies	Chewies can be used as an adjuvant to improve aligner performance and increase the predictability of such mechanics Enhance tray seating and lessen "aligner lag.", Their application lowers the possibility of cumulative misfit across succeeding aligners, improves tracking, and increases force expression. Controlling anterior open bites by applying intrusive forces to the back of the teeth.
MARPE	Separate the midpalatal suture in post-pubertal patients by applying expansion forces through miniscrews.

10. Conclusion

Clear aligner therapy CAT is a modern, safe, and comfortable treatment option for those patients who don’t like to wear visible fixed orthodontic aligners for a more beautiful, comfortable appearance. Nowadays, it has gained good popularity, and this gives a good indicator for its future.CAT has been improved by using auxiliaries for better results with less relapse. There are many auxiliaries like brackets, power ridges, elastics, TADs, and MARPE. The orthodontist selects the appropriate type according to each case. Dental anchorage with CA is very important because of “the third law of physics, where for every force action, there is an equal and opposite reaction”. Utilizing aligners in conjunction with TSADs is a successful therapeutic approach that broadens the scope of complicated cases. The CA-related extra-alveolar miniscrews work well to revoke the patient's permission.

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