Republic of Iraq Ministry of Higher
Education and Scientific Research University
of Mosul College of Dentistry

‘Clear Aligners: A Modern Technique in Treating Dental Misalignment’

A Project Submitted to
The College of Dentistry, University of Mosul, Department of Orthodontics.

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Abstract:

Clear aligners have changed the way orthodontic treatments are performed by providing a more comfortable and aesthetically pleasing alternative to traditional braces. This report explores the materials, design, and fabrication processes of clear aligners and discusses their effectiveness in treating mild to moderate orthodontic issues like crowding, spacing, and minor bite problems. Advancements such as AI-driven treatment planning and 3D printing have significantly improved the accuracy and efficiency of aligner production. Additionally, real-world case studies demonstrate how clear aligners can successfully address various orthodontic challenges. While aligners offer many benefits, such as aesthetics and convenience, their limitations in severe cases and higher costs are also discussed. This report aims to provide a complete understanding of clear aligners and their role in modern orthodontics.

Introduction

Clear aligners have emerged as a modern and innovative alternative to traditional braces, offering patients a comfortable and discreet solution for orthodontic treatment. These transparent trays are effective in addressing mild to moderate issues like crooked teeth, spacing, and minor bite problems.

What sets clear aligners apart is their use of advanced technologies, including digital impressions, artificial intelligence (AI), and 3D printing, to create personalized treatment plans. This technology allows patients to visualize their progress, keeping them motivated throughout the process.

While clear aligners provide many benefits, they have limitations, such as being less effective for severe orthodontic issues. This report examines the materials and technology behind aligners, the design and fabrication process, their pros and

cons, and real-life case studies, while also exploring potential advancements in the field.

Materials Used in Clear Aligners

Clear aligners are primarily made from advanced thermoplastic materials, such as polyurethane or polyethylene terephthalate glycol-modified (PET-G). These materials are chosen because they are biocompatible, durable, and transparent, making them ideal for orthodontic applications. Their flexibility allows for precise pressure to be applied to teeth, facilitating gradual movement. Additionally, the transparency of these materials ensures that the aligners are nearly invisible, a key advantage for patients who prioritize aesthetics during their treatment.

Thermoplastic polymers are also resistant to wear and deformation, which is crucial given the daily stress they endure during usage. Overall, these materials combine strength and comfort, providing an effective orthodontic tool that meets both clinical and patient demands. **(1)**

Steps in Designing and Fabricating Aligners

1. **Digital Impressions**

   The first step in creating clear aligners is obtaining a digital impression of the patient's teeth. This is done using an intraoral scanner, which captures a detailed 3D image of the teeth and gums. Compared to traditional alginate impressions, digital impressions are more accurate and eliminate the possibility of distortions caused by manual handling. They are also much faster and more comfortable for the patient, which improves the overall treatment experience.(2)

(1) Zheng, M., Liu, R., Ni, Z., & Yu, Z., Efficiency, effectiveness, and treatment stability of clear aligners: A systematic review and meta-analysis, Orthodontics & Craniofacial Research, 20(3), 127–133, 2017

(2) Charalampakis, O., Iliadi, A., Ueno, H., & Oliver, D. R., Clinical efficacy of Invisalign orthodontic treatment: A systematic review, Korean Journal of Orthodontics, 48(1), 3–12, 2018

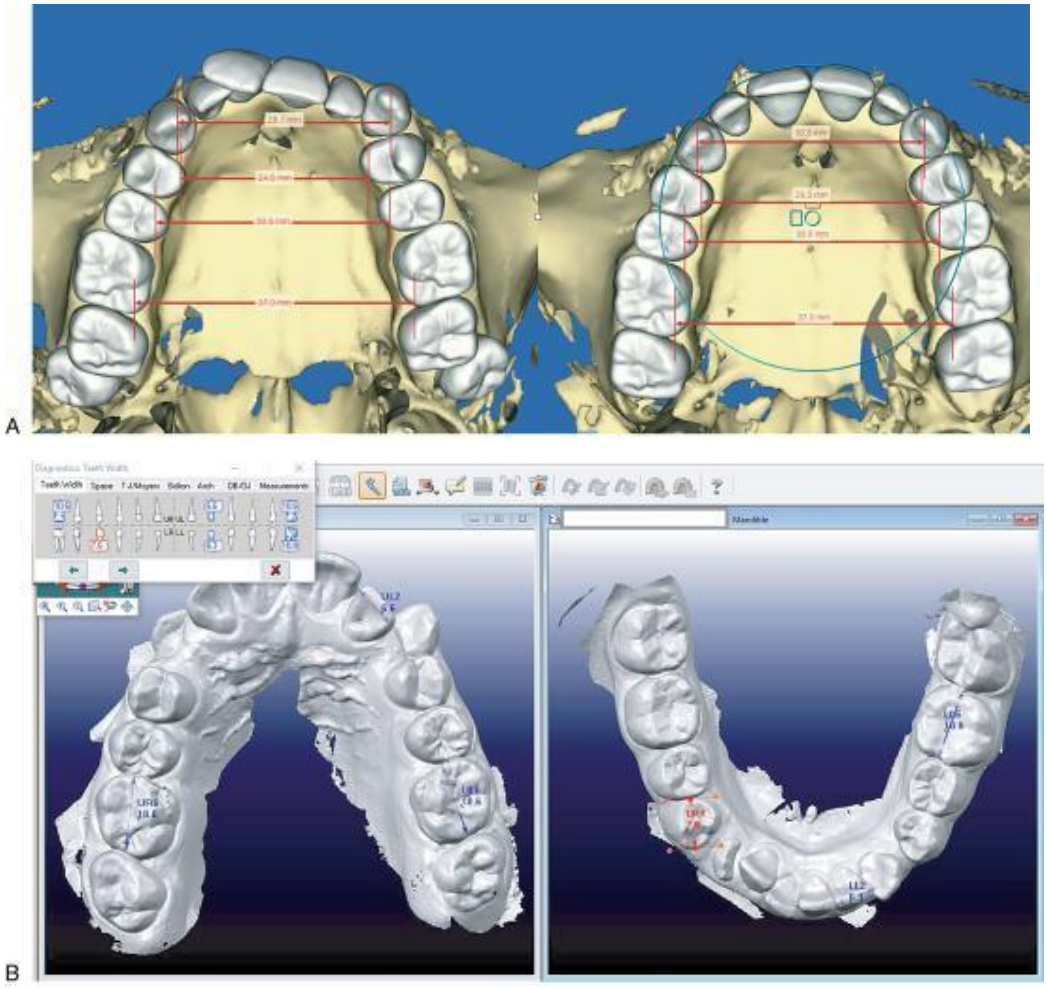

Fig. 1 (A) Digital models and measurements obtained from cone-beam computed tomography data. (B) Digital models and measurements obtained from intraoral scans.

2. **CAD/CAM Technology**

After capturing the digital impressions, the data is processed using Computer-Aided Design (CAD) software. The orthodontist uses this software to plan the entire course of treatment, breaking it down into multiple stages. Each stage corresponds to a specific aligner tray, which will progressively guide the teeth into the desired position.

The design is then sent to a Computer-Aided Manufacturing (CAM) system, which uses technologies like 3D printing to fabricate the aligners. These aligners

are custom-made for each patient and designed to fit perfectly, ensuring both comfort and efficiency in moving the teeth.[1]

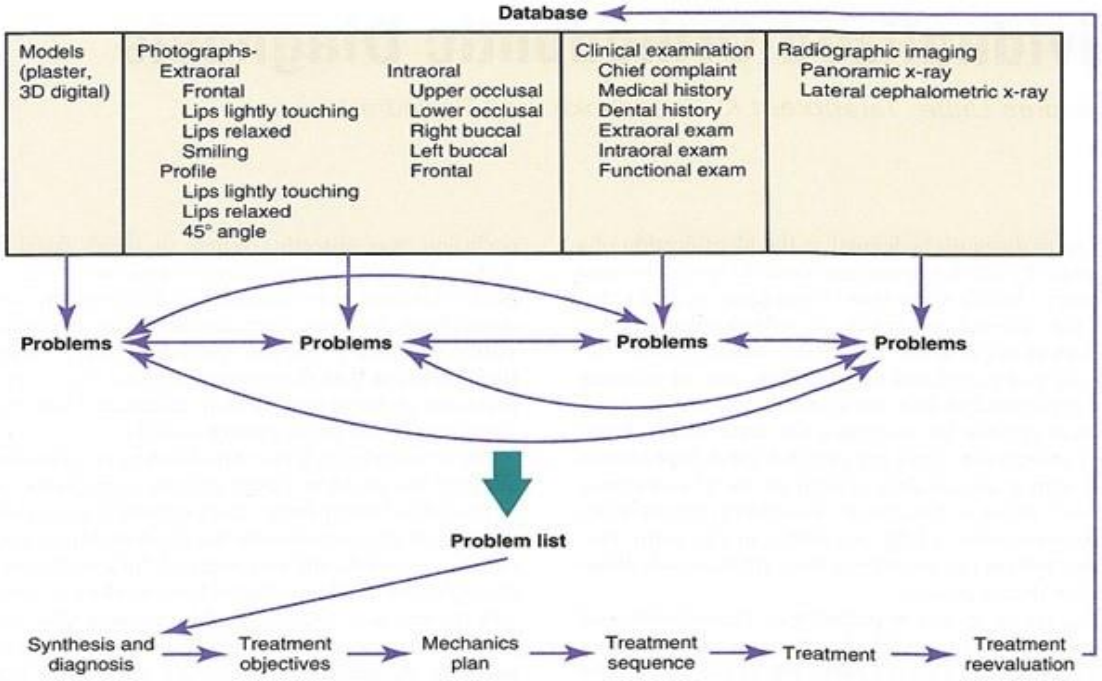

Fig. 2 Steps in diagnosis and treatment planning in the digital orthodontics era.[2]

(1) Papadimitriou, A., Mousoulea, S., Gkantidis, N., & Kloukos, D., Clinical effectiveness of Invisalign orthodontic treatment: A systematic review, Progress in Orthodontics, 19(1), 37, 2018
(2) Modified from Uribe FA, Chandhoke TK, Nanda R. Individualized orthodontic diagnosis. In: Nanda R, ed. Esthetics and Biomechanics in Orthodontics. 2nd ed. St Louis, MO: Elsevier Saunders; 2015:1-32.

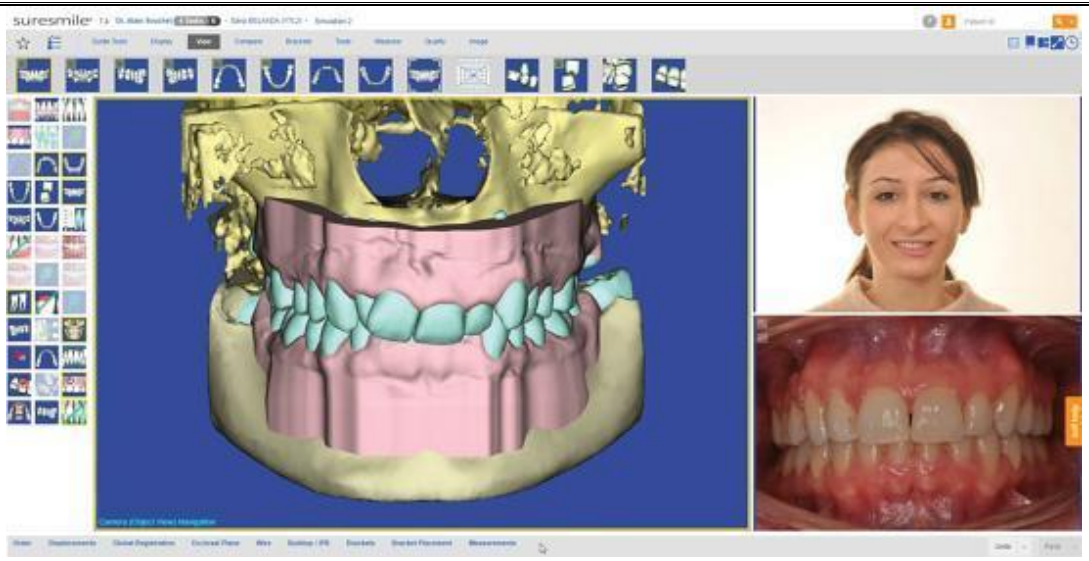

Fig. 3 Integration of cone-beam computed tomography data, facial three-dimensional scan, digital models from intraoral scans, and virtual orthodontic setup. Source: Courtesy of dr. Alain Souchet, Mulhouse, France.

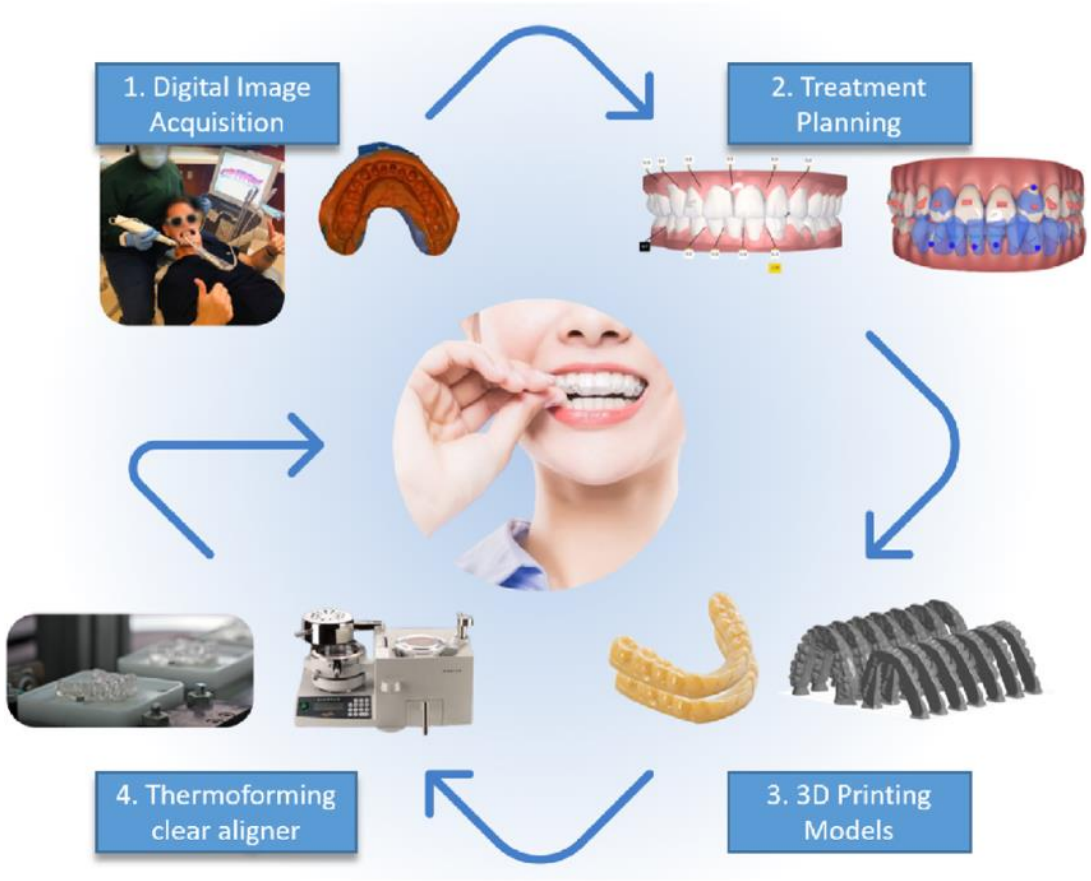

Fig. 4 Workflow of fabrication of clear aligners by the thermoforming process.

Process of Creating Treatment Plans Using Aligners[(1)]

Creating a treatment plan with clear aligners involves several steps that rely on close collaboration between the orthodontist and the digital software.

1. **Assessment and Diagnosis**: The process begins with the orthodontist carefully evaluating the digital impressions of the patient's teeth. This evaluation involves analyzing the alignment and bite issues to establish clear treatment goals. Common goals include correcting crowding, closing gaps between teeth, or addressing minor bite problems. This stage ensures that the treatment plan is tailored to the patient's specific needs.[(2)]
2. **Treatment Simulation**: Using advanced CAD software, a simulation is created to show how the teeth will move at each stage of the treatment. This simulation provides a visual representation of the planned tooth movements and the expected final results. The orthodontist uses this tool to refine the plan, making any necessary adjustments to ensure optimal outcomes. Patients can also view the simulation, giving them a clear understanding of the treatment process and expected results. **[(3)]**
3. **Customization of Aligners**: After finalizing the treatment plan, the aligners are customized for the patient. Each aligner is designed to apply specific forces to the teeth, gradually guiding them into the desired position. This customization

(1) Zheng, M., Liu, R., Ni, Z., & Yu, Z., Efficiency, effectiveness, and treatment stability of clear aligners: A systematic review and meta-analysis, Orthodontics & Craniofacial Research, 20(3), 127–133, 2017

(2) Rossini, G., Parrini, S., Castroflorio, T., Deregibus, A., & Debernardi, C. L. (2015). Efficacy of clear aligners in controlling orthodontic tooth movement: A systematic review. Angle Orthodontist, 85(5), 881–889.

(3) Grünheid, T., Loh, C., & Larson, B. E., How accurate is Invisalign in nonextraction cases? Results of a prospective study, BMC Oral Health, 17(1), 46, 2017

ensures precise and controlled tooth movement, allowing for effective and predictable results.(1)

4. **Fabrication and Delivery**: Once the aligners are designed, they are manufactured using Computer-Aided Manufacturing (CAM) technology, often through 3D printing. Each aligner undergoes quality checks to ensure it meets the specifications of the treatment plan. The orthodontist then provides the aligners to the patient along with detailed instructions on their use and care. Typically, patients wear each set of aligners for 1-2 weeks before progressing to the next set, following the planned sequence of tooth movements.(2)

How Clear Aligners Move Teeth into Proper Alignment

Clear aligners are designed to move teeth gradually into their proper positions by applying consistent and controlled pressure. Each aligner is customized to fit the patient's teeth at a specific stage of treatment. When the aligner is worn, it applies force to targeted teeth, causing the periodontal ligament to stretch on one side and compress on the other. This biological response allows the teeth to shift through the bone. The patient wears a series of aligners, with each aligner designed to move the teeth slightly closer to their desired final alignment. Over time, this sequential movement ensures the teeth are repositioned accurately.(3)

(1) Buschang, P. H., Shaw, S. G., Ross, M., Crosby, D., & Campbell, P. M., Comparative time efficiency of aligner therapy and conventional edgewise braces, Angle Orthodontist, 84(3), 391–396, 2015

(2) Rossini, G., Parrini, S., Castroflorio, T., Deregibus, A., & Debernardi, C. L., Efficacy of clear aligners in controlling orthodontic tooth movement: A systematic review, Angle Orthodontist, 85(5), 881–889, 2015

(3) Khosravi, R., Cohanim, B., Hujoel, P., Daher, S., Neal, M., & Huang, G., Management of overbite with the Invisalign appliance, American Journal of Orthodontics and Dentofacial Orthopedics, 151(4), 691–699, 2017

Fig. 5 clear aligners

Overview of Aligner Trays, Pressure Points, and Controlled Tooth Movement

The aligner trays used in clear aligner therapy are thin, clear, and custom-made to fit snugly over the teeth. These trays are fabricated using advanced thermoplastic materials, ensuring they are both durable and comfortable. Specific pressure points are built into the aligners during the design phase, and these points apply force to the teeth that need to be moved. The pressure is carefully calculated to ensure that tooth movement is both controlled and gradual, typically advancing about 0.2–0.3 mm with each aligner. By wearing each tray as prescribed, the patient allows the forces to act consistently, leading to predictable and precise tooth movements.(1)

Comparison with Traditional Braces

Clear aligners offer several advantages over traditional braces, making them a popular choice among patients. One major benefit is their aesthetic appeal, as the aligners are transparent and nearly invisible compared to the metal brackets and wires of braces. They are also more comfortable since the smooth plastic trays do not irritate the gums and cheeks like braces sometimes do.

Another advantage is that aligners are removable, allowing patients to eat, brush, and floss without restrictions. This makes it easier to maintain good oral

(1) Charalampakis, O., Iliadi, A., Ueno, H., & Oliver, D. R., Clinical efficacy of Invisalign orthodontic treatment: A systematic review, Korean Journal of Orthodontics, 48(1), 3–12, 2018

hygiene. However, this feature also requires patients to wear the aligners for 20-22 hours daily to ensure effective treatment, which relies on patient compliance.

While aligners work well for mild to moderate cases of misalignment, traditional braces are often preferred for more severe cases, such as those requiring complex bite corrections or tooth rotations. Braces are fixed appliances, meaning they work continuously without relying on patient effort, making them more suitable for certain cases.[1][2]

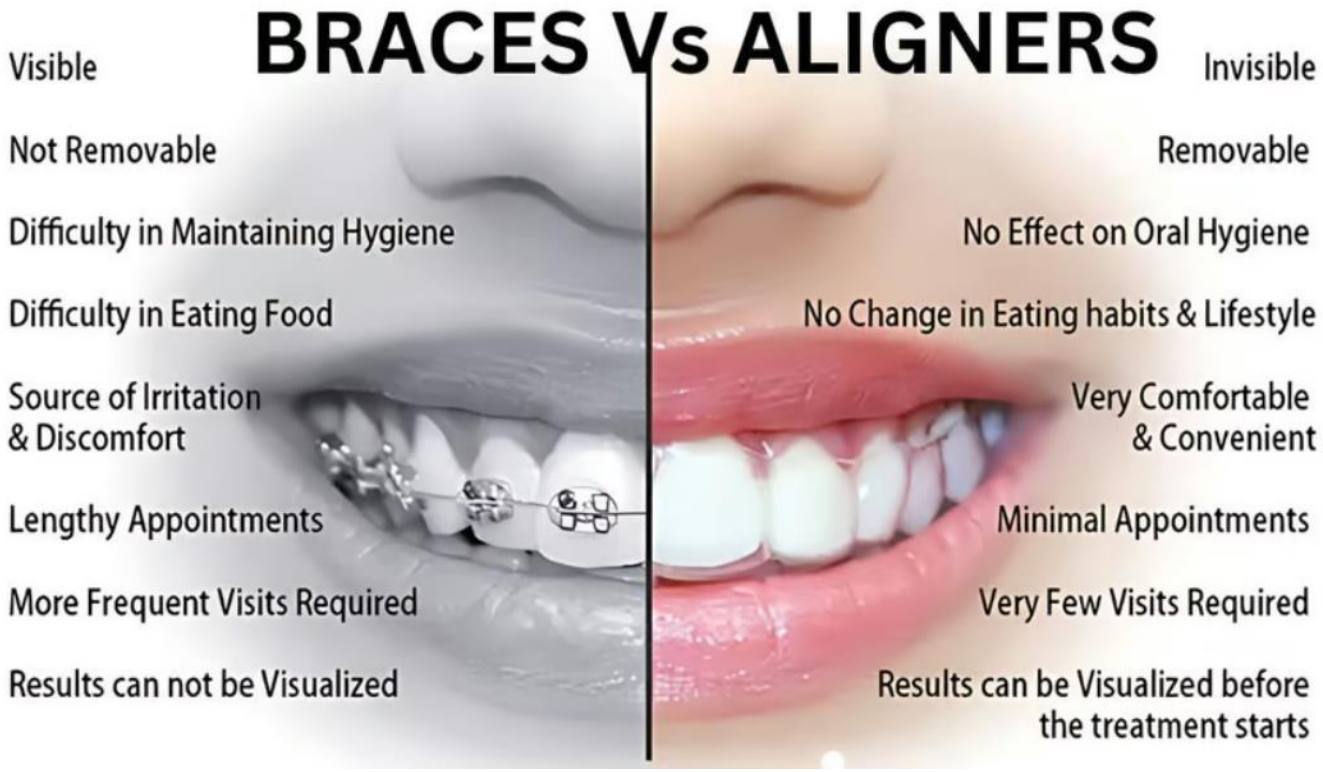

Fig. 6 Traditional Braces VS Clear Aligners[3]

(1) Papadimitriou, A., Mousoulea, S., Gkantidis, N., & Kloukos, D., Clinical effectiveness of Invisalign orthodontic treatment: A systematic review, Progress in Orthodontics, 19(1), 37, 2018
(2) Buschang, P. H., Shaw, S. G., Ross, M., Crosby, D., & Campbell, P. M., Comparative time efficiency of aligner therapy and conventional edgewise braces, Angle Orthodontist, 84(3), 391–396, 2015
(3) Dr Amit Nandi, Are Clear Aligners Right for You? A Guide to Straightening Your Smile, HolySmile Skin and Dental Advance Medical Center, Jora Girja, Kolkata, 2024

Indications and Contraindications for Clear Aligner Use

Indications[1]

Clear aligners are suitable for treating a variety of orthodontic issues, particularly in cases that do not require major skeletal corrections. They are indicated for:

1. **Mild to Moderate Crowding:** Aligners are effective in addressing slight crowding of teeth by creating space and gradually repositioning the teeth into proper alignment.
2. **Spacing Issues:** Aligners can close gaps between teeth, including diastema, using controlled force to bring teeth closer together.
3. **Minor Bite Problems:** Conditions such as mild overbites, underbites, and crossbites can be corrected by carefully planned aligner treatments.
4. **Relapse Cases:** For patients who experience slight shifting of teeth after previous orthodontic treatments, aligners are effective for realignment.
5. **Aesthetic Preferences:** Aligners are clear and provide a discreet treatment option, which is preferred by many adult patients concerned about appearance.

Contraindications:[2]

clear aligners are not suitable for every case. Some situations where they might not work include:

1. **Severe Malocclusions:** Complex bite problems or cases that require significant tooth or jaw adjustments may need braces or surgery instead.
2. **Severe Rotations or Vertical Movements:** Teeth that need to be rotated significantly or moved vertically are harder to treat with aligners.

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(1) Afnan Jamaluddin Ismael, Rasha Y. Al-Darzi, Tikrit Journal for Dental Sciences. Clinical Effectiveness of Invisalign (Clear Aligners) in Orthodontic Tooth Movements, 2022

(2) Buschang, P. H., Shaw, S. G., Ross, M., Crosby, D., & Campbell, P. M. (2014). Comparative time efficiency of aligner therapy and conventional edgewise braces. Angle Orthodontist, 84(3), 391–396.

3. **Skeletal Issues:** If the problem involves the jawbone, aligners are not effective, and traditional braces or surgery may be necessary.
4. **Non-Compliance:** Aligners need to be worn for 20-22 hours daily, and patients who can't follow this may not achieve good results.
5. **Children with Mixed Dentition:** Aligners are not recommended for younger children with baby teeth or partially erupted permanent teeth.

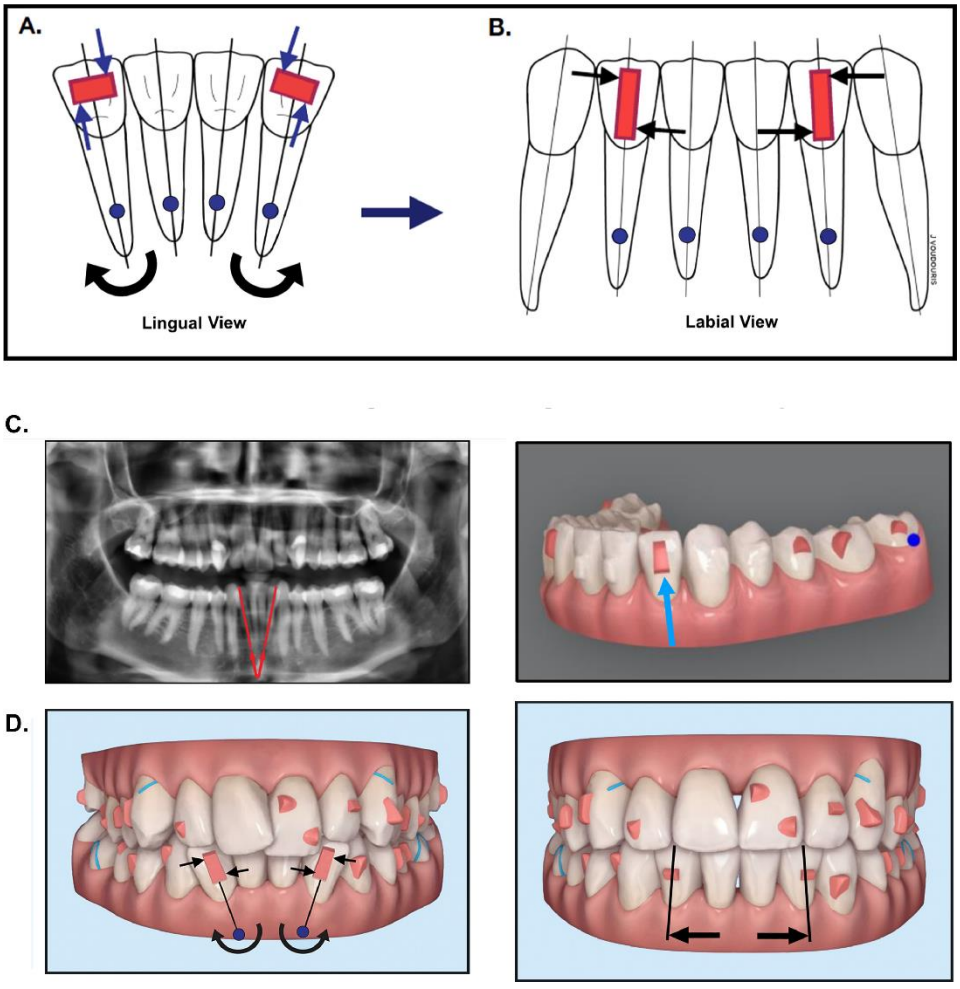

Fig. 7 A detailed close-up image of a clear aligner tray highlighting the strategically placed pressure points designed to apply targeted forces for precise tooth movement.

Specific Cases: Mild to Moderate Crowding, Spacing, and Bite Issues

1. **Mild to Moderate Crowding:** Clear aligners are highly effective for treating mild to moderate crowding, where teeth overlap due to a lack of space in the dental arch. By applying controlled and continuous forces, aligners gradually create the space needed to realign the teeth properly. Each aligner tray is designed to apply specific pressure to targeted teeth, promoting predictable and steady movement. This method offers a less invasive and more comfortable alternative to traditional braces, especially for patients seeking a discreet treatment option.[(1)]
2. **Spacing Issues:** Clear aligners are a reliable solution for addressing spacing issues, such as diastema. These gaps between teeth can be closed effectively as the aligners exert gentle pressure on adjacent teeth, gradually bringing them closer together. The ability of aligners to handle spacing problems has improved with advancements in their design and material. For patients with mild to moderate spacing, aligners offer a precise and aesthetic treatment option that maintains comfort throughout the process.[(2)]
3. **Bite Issues:** Clear aligners are effective for treating minor bite problems, including overbite, underbite, and crossbite. These issues, while not severe, can affect both the functionality and appearance of a patient's teeth. Aligners provide a practical and aesthetic solution for addressing these problems.

(1) Barashi, M. A., Habis, R. M., & Alhazmi, H. A., Predictability of Orthodontic Space Closure Using Invisalign Clear Aligners: A Retrospective Study, Cureus, 16(3), 2024
(2) Pagani, R., et al., The use of Invisalign in the management of orthodontic treatment before and after Class III surgical approach, Case Reports in Dentistry, 2016

3.1. **Overbite:** Overbite occurs when the upper front teeth excessively overlap the lower front teeth. Clear aligners gradually reduce this overlap by gently repositioning the teeth to improve alignment.

3.2. **Underbite:** In cases of underbite, where the lower teeth extend beyond the upper teeth, aligners work to shift the lower teeth backward or the upper teeth forward, creating proper alignment between the arches.

3.3. **Crossbite:** Crossbite refers to misalignment where some upper teeth sit inside the lower teeth when the mouth is closed. Clear aligners selectively adjust the affected teeth, moving them into the correct position over time.(1)

Clear aligners are particularly suitable for mild to moderate bite problems. Their removable nature allows patients to maintain better oral hygiene compared to traditional braces, which can be difficult to clean around. However, for severe bite issues or skeletal discrepancies, alternative treatments such as braces or surgery may be necessary to achieve optimal results.(2)

Clear aligners Advantages:

1. **Aesthetics**: Clear aligners are nearly invisible, offering an aesthetic advantage over traditional braces. This is particularly appealing to adults and teenagers who are self-conscious about their appearance during orthodontic treatment.(3)
2. **Comfort and Convenience**: Made of smooth, custom-fit thermoplastic material, aligners do not have sharp edges that can irritate the gums or cheeks, unlike metal brackets and wires in traditional braces. Additionally, they can be removed for

(1) Ghislanzoni, L. H., et al., How well does Invisalign ClinCheck predict actual results: A prospective study, Orthodontics & Craniofacial Research, 27, 465–473, 2024
(2) Kim, A. S. (2013). Treatment Effectiveness of the Invisalign System: A Systematic Review. Temple University Graduate Board, 2013
(3) Lan Huong Timm, et al., Factors Influencing Patient Compliance during Clear Aligner Therapy: A Retrospective Cohort Study, Journal of Clinical Medicine, 2021

eating, brushing, and flossing, providing greater convenience for daily activities.(1)

3. **Improved Hygiene During Treatment**: Since aligners are removable, patients can maintain excellent oral hygiene by brushing and flossing effectively. This helps reduce the risk of plaque buildup and gum disease, which can be common with fixed braces.(2)

Clear aligners Limitations:

1. **Cost**: Clear aligners tend to be more expensive than traditional braces. The higher cost is associated with the advanced materials used, the precision manufacturing process, and the technology involved in designing custom aligners.(3)
2. **Limitations in Severe Cases**: Aligners are most effective for mild to moderate orthodontic issues. Severe malocclusions, significant tooth rotations, or skeletal discrepancies may require alternative treatments such as braces or even surgical interventions.(4)

Importance of Wearing Aligners as Instructed

Wearing aligners as instructed is one of the most important factors for successful treatment. Patients are usually told to wear their aligners for 20-22 hours a day, only taking them out to eat, drink (except water), or clean their teeth. This consistent wear is what allows the teeth to move according to the treatment plan. Each aligner in the

(1) Kulshrestha R, Clear Aligners vs Fixed Orthodontic Treatment – Where are we now?, Journal of Dentistry & Oral Disorders, 2017.
(2) Afnan Jamaluddin Ismael, Rasha Y. Al-Darzi, Tikrit Journal for Dental Sciences. Clinical Effectiveness of Invisalign (Clear Aligners) in Orthodontic Tooth Movements, 2022
(3) Dr Werner Schupp, Dr Julia Haubrich, Dr Tommaso Castroflorio, Clinical efficacy of Invisalign® treatment with weekly aligner changes: Two case reports, Invisalign, 2015
(4) Zaid Alaa Abdulhussein , Alev Aksoy, Compliance of patients with Class III malocclusion to orthodontic treatment, Journal of Baghdad College of Dentistry, Vol. 34, No. 1, 2022

series is designed to make small adjustments to the teeth, so skipping or wearing aligners for fewer hours than recommended can delay progress or even result in teeth moving in unintended ways. Non-compliance can also mean needing extra aligners or extending the treatment time, which can be frustrating for both the patient and the orthodontist.(1)

Challenges Faced by Patients:

1. **Speech Changes:** One common challenge patients face at the start of treatment is changes in their speech. Having the aligners in the mouth can make it harder to pronounce certain sounds, like "s" and "z," because the tongue is adjusting to the new space. This can be a bit embarrassing, especially in social or professional settings. However, most patients adapt after a few days or weeks as they get used to speaking with the aligners in place. (2)
2. **Initial Discomfort:** Another challenge is the discomfort that some patients experience when they first start wearing aligners or when they switch to a new set. The pressure from the aligners can make the teeth feel sore, and the edges of the aligners might irritate the cheeks or tongue. This discomfort is usually temporary and goes away after a few days. Patients can also use orthodontic wax or file down rough edges on the aligners to make them more comfortable.

   These challenges are normal and temporary, but they can be discouraging for some patients. That’s why it’s important for orthodontists to explain what to expect and give tips on how to manage these issues. Staying consistent with

(1) Dr Werner Schupp, Dr Julia Haubrich, Dr Tommaso Castroflorio, Clinical efficacy of Invisalign® treatment with weekly aligner changes: Two case reports, Invisalign, 2015
(2) Renato Pagani, et al., Case Report The Use of Invisalign, System in the Management of the Orthodontic Treatment before and after Class III Surgical Approach, Hindawi Publishing Corporation, 2016

wearing aligners and pushing through the initial adjustment period is essential for achieving the best results.(1)

Integration of AI in Treatment Planning

Artificial intelligence (AI) has become a game-changer in clear aligner treatment planning. Systems like Invisalign's ClinCheck software use AI to create virtual treatment plans that simulate how the teeth will move throughout the process. These plans are based on data from thousands of previous cases, making them highly accurate and personalized for each patient. AI helps orthodontists predict the effectiveness of each stage, ensuring that the aligners are designed to achieve optimal results. Additionally, patients can see a preview of their expected smile, which helps them stay motivated and committed to wearing the aligners as instructed.(2)

Use of 3D Printing Technologies

3D printing has revolutionized how clear aligners are made. Using advanced 3D printers, companies can produce precise aligner molds from digital scans of a patient's teeth. These printers, like those that use stereolithography (SLA) technology, create detailed and accurate models that fit the patient perfectly. The process is fast and efficient, allowing manufacturers to produce a series of aligners in a short amount of time. What makes 3D printing especially valuable is its ability to customize aligners for each patient, ensuring better treatment outcomes and a more comfortable experience.(3)

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(1) Renato Pagani, et al., Case Report The Use of Invisalign, System in the Management of the Orthodontic Treatment before and after Class III Surgical Approach, Hindawi Publishing Corporation, 2016

(2) Luis Huanca Ghislanzoni, How well does Invisalign ClinCheck predict actual results: A prospective study, Orthodontics & Craniofacial Research, 2018

(3) Dr. Shyamala Naidu and Dr. Anand Suresh, INVISALIGN – A BRIEF OVERVIEW, International Journal of Advanced Research (IJAR), 2018

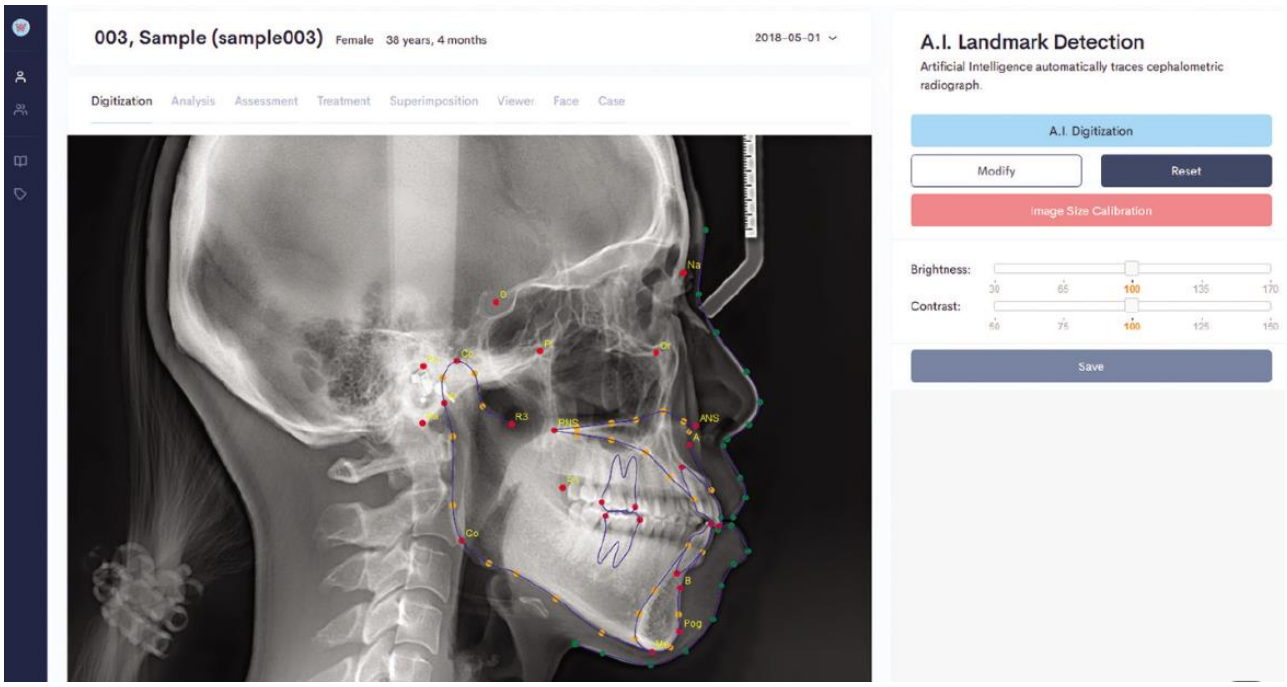

Fig. 8 Cephalometric automatic point detection.

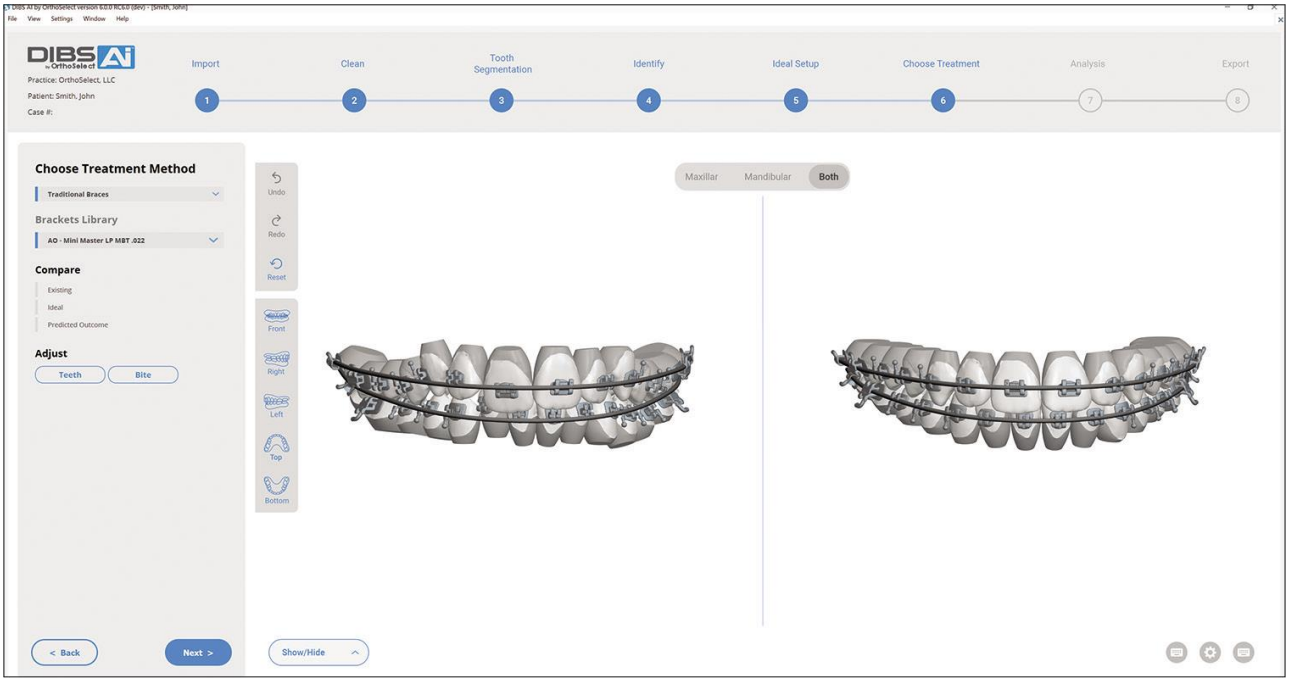

Fig. 9: Indirect bracketing using artificial intelligence.

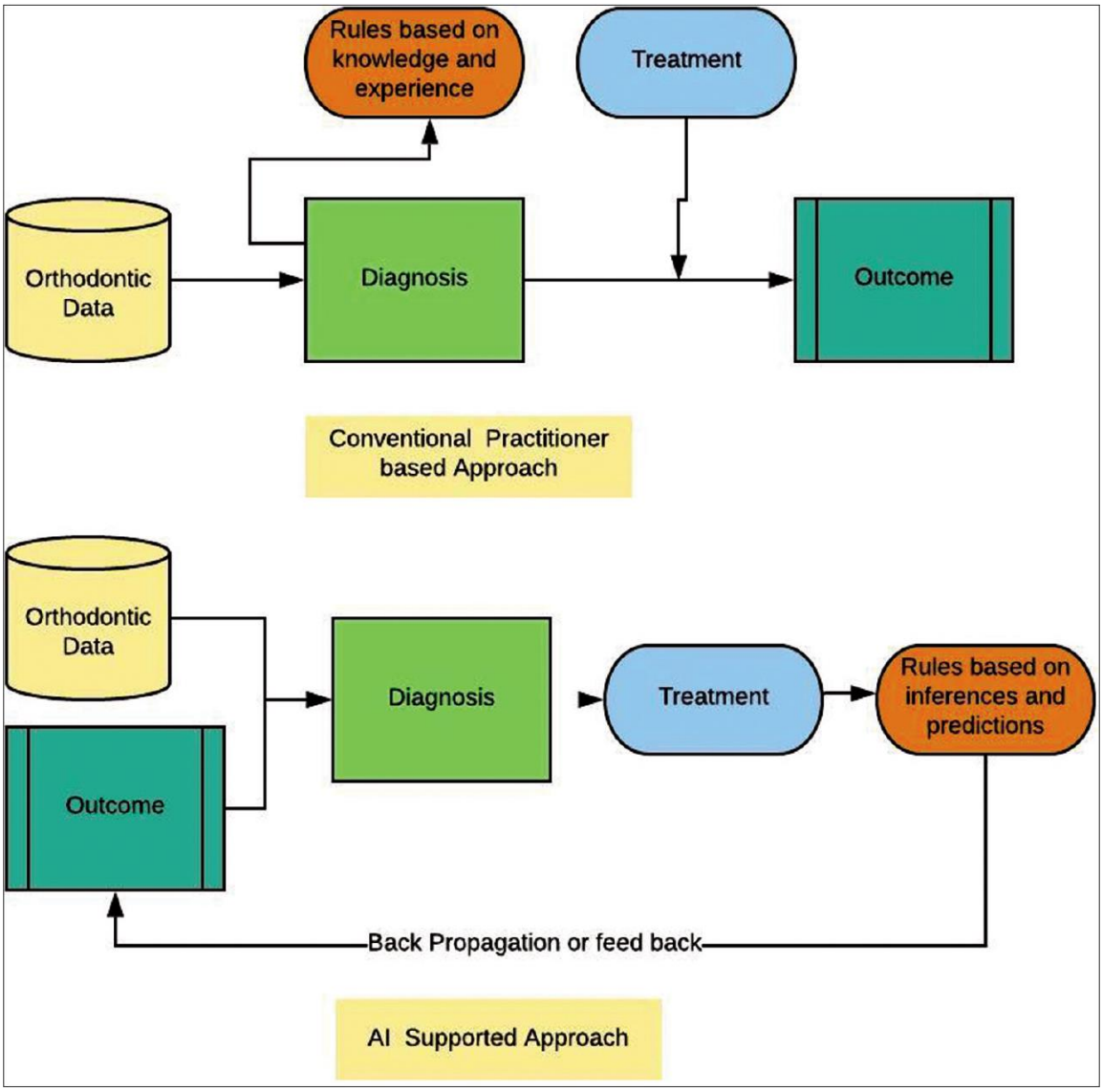

Fig. 10 (a) Conventional approach to diagnose and treatment plan an orthodontic case. (b) Artificial intelligence supported approach to diagnose and treatment plan orthodontic cases.

Potential Advancements in Materials and Designs: The future of clear aligners looks promising with ongoing research into better materials and designs. Scientists are developing new thermoplastics that are more durable, flexible, and comfortable, while still being transparent. These materials aim to improve how well aligners can handle complex tooth movements without compromising patient comfort. Future designs may also include smart features, such as built-in sensors to track wear time and pressure points, which would give both patients and orthodontists real-time feedback to optimize the treatment.(1)

Cases:

Case 1: Class II and Deep Bite Correction

1. **Patient Details:** A 37-year-old adult patient had Class II Division 2 malocclusion with a deep bite and craniomandibular disorder (CMD) causing severe pain.
2. **Treatment Goals:** The goal was to achieve a Class I relationship, resolve crowding, reduce the deep bite, and alleviate CMD symptoms.
3. **Treatment Plan:**
   - Aligners were changed weekly to speed up the treatment process.
   - Attachments and Class II elastics were used to correct the bite and distalize the upper molars.
   - Interproximal reduction (IPR) was performed to manage crowding.
4. **Outcome:** The treatment successfully corrected the bite to a Class I relationship, resolved the deep bite, and eliminated CMD symptoms. The weekly aligner changes reduced the treatment duration by 50% compared to the standard biweekly schedule.(2)

(1) Gabriele Rossini, Efficacy of clear aligners in controlling orthodontic tooth movement: A systematic review, Angle Orthodontist, Vol 85, No 5, 2015
(2) Dr Werner Schupp, Dr Julia Haubrich, Dr Tommaso Castroflorio, Clinical efficacy of Invisalign® treatment with weekly aligner changes: Two case reports, Invisalign, 2015

Case 2: Teenage Patient with Deep Bite and Impacted Premolar

1. **Patient Details:** A 12.9-year-old teenager presented with a deep bite, increased overjet, and an impacted first premolar.
2. **Treatment Goals:** The treatment aimed to correct the deep bite, bring the impacted premolar into the arch, and establish a functional and stable bite.
3. **Treatment Plan:**
   - The first phase focused on arch expansion and molar derotation using aligners.
   - The second phase included orthodontic traction of the impacted premolar using buttons and elastics integrated into the aligners.
4. **Outcome:** The premolar was successfully guided into position without needing fixed braces. Weekly aligner changes kept the treatment time shorter, making it easier for the patient to stay compliant.(1)

Case 3: Class III Malocclusion with Crossbite

1. **Patient Details:** A 23-year-old male had a Class III malocclusion, mandibular deviation to the left, and a crossbite involving teeth 2.2, 2.3, and 2.4.
2. **Treatment Goals:** The aim was to correct the mandibular deviation and crossbite while maintaining skeletal stability.
3. **Treatment Plan:**
   - Aligners were used during both pre- and postsurgical phases.
   - Interproximal reduction (IPR) and custom attachments were applied to improve precision.
   - Orthognathic surgery was performed to address the skeletal discrepancy.

(1) Dr Werner Schupp, Dr Julia Haubrich, Dr Tommaso Castroflorio, Clinical efficacy of Invisalign® treatment with weekly aligner changes: Two case reports, Invisalign, 2015

4. **Outcome:** The treatment successfully corrected the dental and skeletal asymmetry. The patient maintained stable results over a 6-year follow-up and was highly satisfied with the functional and aesthetic improvements.(1)

Conclusion

Clear aligners have become a game-changer in orthodontics by providing an effective, comfortable, and visually appealing way to correct dental issues. Made from advanced thermoplastic materials, these aligners rely on cutting-edge technologies like AI and 3D printing to ensure precise and customized treatment for each patient. Their benefits, including aesthetics, convenience, and improved oral hygiene, make them a preferred choice for many individuals.

However, clear aligners are not without limitations. They are more expensive than traditional braces and may not be effective for severe orthodontic cases. Despite these challenges, ongoing advancements in materials and designs are likely to make aligners even more versatile and accessible in the future.

Through real-world examples and technological insights, this report demonstrates how clear aligners continue to shape the future of orthodontics. With their ability to combine innovation and patient comfort, clear aligners are truly transforming the way dental treatments are approached.

(1) Renato Pagani, et al., Case Report The Use of Invisalign, System in the Management of the Orthodontic Treatment before and after Class III Surgical Approach, Hindawi Publishing Corporation, 2016

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1. Buschang, P.H., Shaw, S.G., Ross, M., Crosby, D., & Campbell, P.M. (2014) Comparative time efficiency of aligner therapy and conventional edgewise braces. Angle Orthodontist, 84(3), pp.391–396.
2. Charalampakis, O., Iliadi, A., Ueno, H., & Oliver, D.R. (2018) Clinical efficacy of Invisalign orthodontic treatment: A systematic review. Korean Journal of Orthodontics, 48(1), pp.3–12.
3. Dr Amit Nandi (2024) Are Clear Aligners Right for You? A Guide to Straightening Your Smile. HolySmile Skin and Dental Advance Medical Center, Jora Girja, Kolkata.
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