



## Editorial

# The carbon emissions of clear aligner therapy: A critical review

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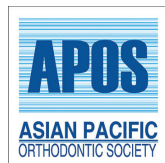
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Clear aligner therapy (CAT) has revolutionized orthodontic treatment by offering patients a discreet and comfortable alternative to traditional braces. It utilizes custom-made plastic aligners to gradually guide the teeth into their desired position. This approach has many benefits, including invisibility, comfort, and convenience of being removable for eating and brushing.<sup>[1]</sup> As manufacturing techniques have evolved from vacuum forming to three-dimensional (3D) printing, their advantages have expanded. 3D printing allows for intricate geometric structures, faster production, personalized designs for patients, and reduced material and labor costs. These advancements have made aligner treatments less invasive and more cost-effective while maintaining their effectiveness compared to traditional options.<sup>[2]</sup>

However, further research is needed to enhance the effectiveness of tooth movement. Areas such as aligner retention, improved attachments, and enhanced processing techniques could benefit from further investigations. The dental industry is looking toward the future with four-dimensional printing, which holds the promise of even more effective treatments and improved quality of life for patients.<sup>[2]</sup> However, it is crucial to acknowledge and address the environmental impacts associated with CAT production and use.

Plastics, the primary materials used to fabricate clear aligners, are known for their non-biodegradable nature.<sup>[3]</sup> It takes hundreds of years for these materials to fully decompose, leading to long-term environmental damage. Moreover, the incineration of plastics releases hazardous substances into the atmosphere, posing a threat to all living organisms.<sup>[4]</sup> Studies have demonstrated that even trace amounts of these particles in the environment can lead to diseases such as immune system changes, prostate enlargement, diabetes, hyperactivity, infertility, obesity, precocious puberty, and breast cancer.<sup>[5]</sup> Therefore, while clear aligners provide individuals with discreet and convenient options for orthodontic treatment, it is crucial to scrutinize their environmental impact in light of the urgent need to reduce carbon emissions worldwide.

One potential approach to reduce carbon emissions from aligners is to decrease the number of aligners through hybrid aligner treatment (HAT). HAT combines clear aligners with other devices, such as fixed appliances or laboratory-fabricated appliances, to address the limitations of clear aligners in certain tooth movements. By leveraging the advantages of removable aligners with other devices, the number of aligners required can be reduced, particularly in challenging cases treated with CAT.<sup>[6]</sup>

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While dental professionals and aligner manufacturers bear the responsibility of mitigating these limitations and minimizing the environmental impact, patients also play a crucial role in addressing the sustainability concerns associated with their treatment. Encouraging patients to recycle their aligners and packaging is a fundamental step toward promoting sustainability. Dental clinics offering CAT can contribute by establishing dedicated recycling containers for aligner-related waste, creating awareness among patients regarding the environmental impact, and providing guidance on proper disposal methods.<sup>[7]</sup>

CAT has undoubtedly revolutionized orthodontic treatment; however, the environmental challenges they present must not be overlooked. Dental professionals, aligner manufacturers, and patients must collaborate to mitigate these limitations and minimize the environmental impact of CAT. Through continuous research, improved practices, and innovative solutions, sustainable orthodontic treatments can be developed to preserve our planet while enhancing the patients' smiles.

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