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The Anticipated Outcome of Clearpath Aligners in Resolving Crowding: A Case Report

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Abstract

This case report is based on the clear aligner treatment of an adult patient who presented with moderate crowding and an unpleasant smile. Crowding was treated with arch expansion and interproximal reduction. A total of 28 sets of clear aligners were delivered, with a wear time of 22 hours per day for 10 days. The treatment duration was 10 months. Thus, the case study underscores the reliability of orthodontic treatment with clear aligners for addressing moderate crowding. The discreet nature of these aligners not only enhances periodontal health but also increases patient acceptance.

Introduction

Clear aligners have demonstrated their versatility in addressing a range of malocclusions, including crowding, spacing issues, and teeth that are out of alignment. At the inception of clear aligners in orthodontics, their primary purpose was to address mild crowding. However, as materials and computer-aided tooth movement design have advanced, the scope of clear aligner applications has expanded to encompass moderate to severe crowding, whether they involve extraction or non-extraction approaches [1]. They can also be effectively utilized in cases involving open bite corrections and class III malocclusions [2]. Nevertheless, the effectiveness of aligners can vary depending on the complexity of the case and the specific tooth movements required. It's worth noting that the forces exerted by aligners are comparable to those produced by traditional fixed appliances [3,4].

Clear aligners can effectively address crowding issues through various methods, including proclining teeth, arch expansion, interproximal reduction (IPR), and, in severe cases, extraction, much like the techniques employed in traditional orthodontic treatments [5,6]. Nevertheless, it's important to note that in extraction cases, achieving pure translation movements with aligners may be less predictable when compared to other orthodontic approaches [7].

This case report is focused on utilizing clear aligner treatment to rectify a condition of moderate crowding in the patient's dentition. It aims to document the process, progress, and outcomes of this specific orthodontic treatment in addressing the crowding issue. The report will likely include details about the treatment plan, the application of clear aligners, the patient's response to the treatment, any challenges encountered, and ultimately, the success achieved in resolving the crowding problem. This information can serve as a valuable reference for other practitioners and patients considering similar treatment for moderate crowding issues.

Case Report

A 29-year-old healthy male sought our dental services with concerns regarding tooth crowding and an unsightly smile. The patient's medical history was largely uneventful, except for a prior unsuccessful attempt at orthodontic treatment, which involved the extraction of a lower incisor. During the extraoral examination, we noted that the patient had a well-proportioned face, an orthognathic profile, competent lips, and an acute nasolabial angle. There were no reported symptoms or alterations related to the temporomandibular joint.

Upon smile analysis, we found that there was an adequate display of incisors, but the alignment of the teeth was suboptimal. Intraoral examination of the patient revealed Class I relationships for both molars and canines. The overjet (horizontal overlap of the upper and lower teeth) was excessive, while the overbite (vertical overlap of the upper and lower teeth) was within acceptable limits. Notably, the midline of the maxillary teeth deviated 1mm to the left of the patient's facial midline.

Intraorally, the patient exhibited moderate crowding in both the upper and lower dental arches, with 5mm of crowding in the maxilla and 6mm in the mandible. A panoramic radiograph confirmed that the patient had a healthy periodontal condition with no signs of cavities, root resorption, or any dental or pathological abnormalities. Additionally, cephalometric analysis revealed a skeletal Class I relationship and a normodivergent facial pattern.

Treatment Objectives

The primary goal of the orthodontic treatment was to address crowding concerns through the use of clear aligners. Secondary

goals included the establishment of a healthy, functional, and lasting occlusion, as well as the enhancement of dental aesthetics.

Treatment Options

We discussed various treatment choices with the patient, which included:

- The initial option involved traditional braces for orthodontic treatment. However, the patient declined this option due to their preference for a more aesthetic appliance.
- The second option was to use clear aligners, aligning with the patient's desire for a more esthetic solution.

Treatment procedure

Taking into account the patient's youthful age of 29 and his dynamic involvement as a speaker and active member of the social community, he preferred the clear aligner system. Consequently, we proceeded to gather intraoral and extraoral photographs, PVS impressions, panoramic X-rays, and lateral cephalometric records. These collected records were transmitted to the ClearPath facility for the formulation of a customised treatment plan.

The panoramic X-ray affirmed the presence of ample bone structure and showcased excellent oral hygiene, thereby meeting the essential criteria for orthodontic treatment. No further dental procedures were required, rendering the case suitable for the continuation of clear aligner treatment.

After submitting the records, a 3D treatment plan was generated. This plan involved 28 stages of treatment, including arch expansion and interproximal reduction (IPR) for both the upper and lower arches. A treatment simulation was presented to the patient for review, and upon their satisfaction, approval was granted.

The treatment plan was received and discussed with the patient within 10 days of the data submission. The patient expressed high levels of satisfaction with the proposed treatment plan, and no modifications were deemed necessary. A total treatment duration of 1 year and 2 months was recommended to the patient, which they readily approved. Consequently, treatment commenced shortly thereafter.

IPR Technique

Interproximal reduction is the technique of carefully removing the thin enamel layer interproximally between the neighbouring teeth to unravel crowding [8]. There are different methods of IPR, including burs, discs, and abrasive strips [9]. In this study, IPR was achieved using a thin diamond-coated double-sided abrasive strip. It was measured using an IPR gauge, followed by the application of topical fluoride to avoid any adverse effects.

***Fig*:** (a) (b) (c)

Fig: (d) (e) (f) (g) (h)

Figure 1: *Pre-Treatment Extraoral (A), (B), (C) & Intraoral Photographs (D), (E), (F), (G), (H).*

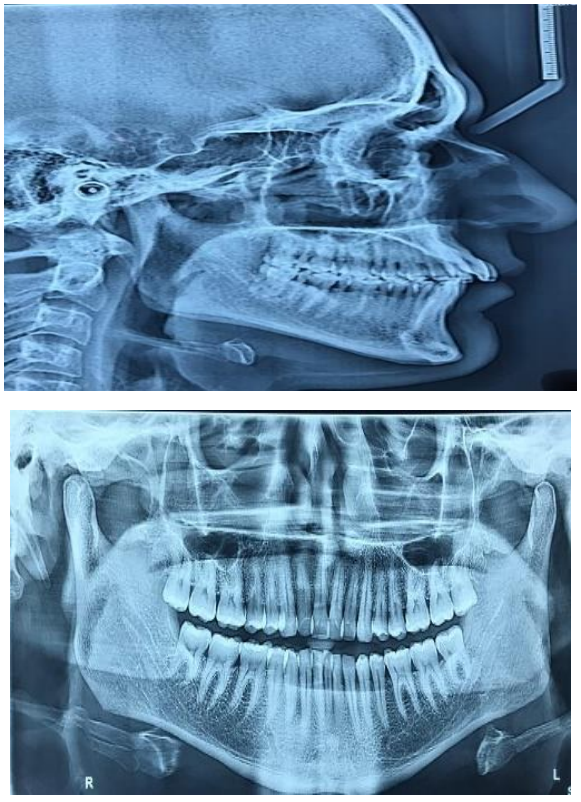
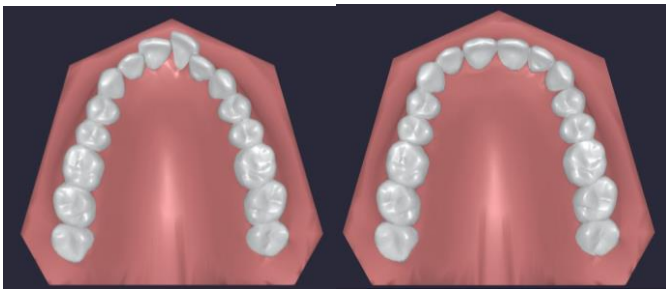


Figure 2: *(A) Orthopantomograph (B) Lateral Cephalogram.*



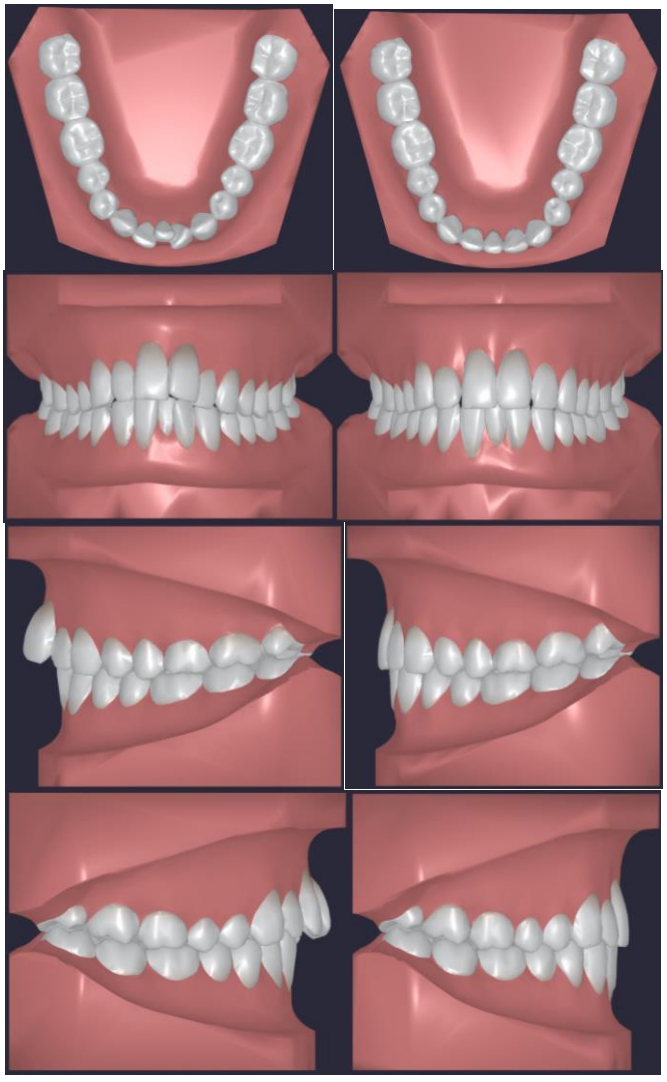


Figure 3: *3D Treatment Plan (A) Before (B) After.*

Treatment progress

Treatment commenced in January 2020. Within two weeks, we received the IPR and MRF forms from the aligner facility, along with 28 sets of upper and lower aligners. The recommended wear time for each set was 22 hours per day for ten days. The patient received comprehensive guidance on oral hygiene and periodontal health. Initially, the patient was provided with the first set of aligners and was scheduled for an IPR appointment before starting the second set. We performed an IPR procedure, reducing 0.6mm between the upper laterals and canines bilaterally and 0.7mm between the upper canines and first premolars bilaterally.

Subsequently, the patient received the next sets of aligners and was evaluated for periodontal health and aligner tracking every three months, with satisfactory results. An IPR visit was scheduled again after aligner 23, during which 0.6mm of enamel was removed between the upper left central and lateral incisors before providing the next batch of aligners. The patient demonstrated good compliance, and the treatment was successfully completed.

Following the treatment, two sets of retainers were issued. The

patient was instructed to wear them full-time for the first six months, followed by night-time wear for three months, and then alternate-night-time wear for the remaining three months.

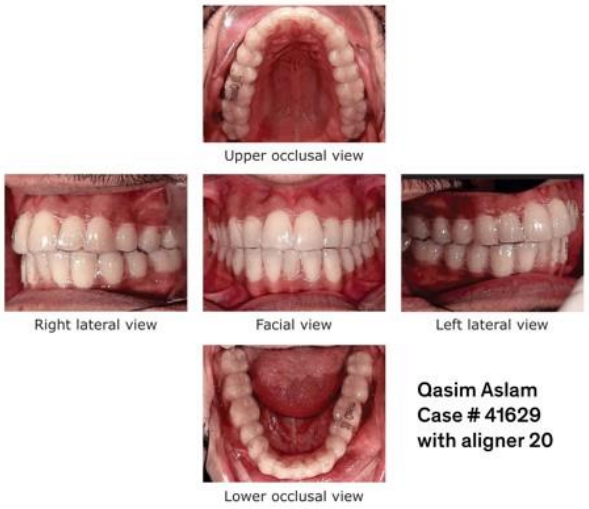


Figure 4: *Mid Treatment Records, Aligners Fitting Well # 20.*

Stg. #	Lower Right								Lower Left							
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
1																
2							BTP					BTP				
3					BTP		BTR					BTR				
4					BTR		BTP					BTP				
5					BTP	BTP	BTP				BTP	BTR				
6					BTR	BTP	BTR				BTR					
7						BTR	BTP			BTP	BTP					
8				BTP			BTR			BTR	BTP					
9							BTP	BTP			BTR		BTP			
10				BTR				BTR		BTP	BTP					
11								BTP		BTR	BTP		BTR			
12							BTP	BTR		BTP	BTR					
13				BTP	BTP							BTP	BTP			
14				BTR			DTO			INT			BTP			
15							MRO	INT		MRO						
16						DRO		BTP			DRO		BTR			
17					BTR	DRO		BTR		MRO						
18						DRO		INT		MRO	INT					
19						DRO		BTP		MRO						
20				BTP	BTP					MRO		BTP	BTP			
21								INT			INT					
22					MRO		INT			INT						
23					MRO		MRO			MRO						
24						LTP	LTP	LTP		LTP	LTP					
25						LTP	LTP	LTR		LTP	LTR					
26					MRO		LTR	LTP		LTR	LTP					
27						LTR	LTP	LTR		LTP	LTR					
28						LTP	LTR	LTP		LTR	LTP					

Dark lines indicate that IPR need to be done on this stage before inserting aligner

Please use EBT on specific teeth/tooth ONLY at the particular stage mentioned in MRF form.
EBT technique has to be used wherever "EXT" code is written.

Code	Movement Detail	Code	Movement Detail	Code	Movement Detail
MTR	Mesial Translation	MTP	Mesial Tipping	DTO	Distal Torque
DTR	Distal Translation	DTP	Distal Tipping	MTO	Mesial Torque
LTR	Lingual Translation	BTP	Buccal Tipping	INT	Intrusion
BTR	Buccal Translation	BTO	Buccal Torque	EXT	Extrusion
LTP	Lingual Tipping	LTO	Lingual Torque	DRO	Distal Rotation
				MRO	Mesial Rotation

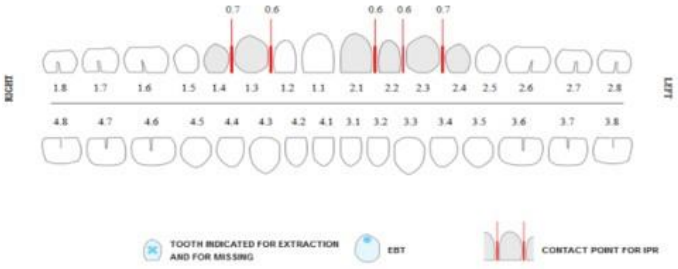


Figure 5: *IPR Form.*

Stg. #	Upper Right								Upper Left							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2					MTP				BTP							
3					MTR				BTP		BTP					
4					BTP				BTP		BTR	MTP				
5								BTP	BTR		BTP	BTP				
6				BTP	BTR					DTP		BTR				
7								BTR	BTP			BTP	BTP			
8				BTR	BTP					DTR	BTP					
9							BTP	BTP				BTP	BTR			
10							BTP	BTR		BTR						
11						BTP		BTP		BTP	BTP					
12					BTR				MRO	BTP		BTR				
13						BTP	BTR		MRO				BTP			
14				BTP	BTP				MRO			BTP	BTR			
15								DRO								
16				BTP	BTR		BTP			BTR		BTR				
17					BTP	BTR		DRO			BTR	BTP				
18				BTR	BTP		DRO					BTR	BTP			
19						BTP	DRO	MTO		DTP						
20				DTP	DTP			MTO				DTP	DTP			
21						LTP	LTP	LTP	LTP	LTP						
22						LTR	LTP	LTR	LTP	LTR	LTP					
23						LTP	LTR	LTP	LTR	LTP	LTP					
24				DTP	DTR		LTP					DTP	DTR			
25								LTR	LTP	LTP	LTR					
26							LTP	LTP	LTP	LTR						
27							LTR	LTP	LTR	LTP	LTP					
28						LTR	LTP	LTR	LTP	LTR	LTP					

Stg. #	Lower Right								Lower Left							
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
1																
2							BTP					BTP				
3					BTP		BTR					BTR				
4					BTR		BTP					BTP				
5					BTP	BTP	BTP				BTP	BTR				
6					BTR	BTP	BTR				BTR					
7						BTR	BTP			BTP	BTP					
8				BTP			BTR			BTR	BTP					
9							BTP	BTP			BTR		BTP			
10				BTR				BTR		BTP	BTP					
11								BTP		BTP			BTR			
12							BTP	BTR		BTP	BTR					
13				BTP	BTP							BTP	BTP			
14				BTR			DTO			INT			BTP			
15							MRO	INT		MRO						
16						DRO		BTP			DRO		BTR			
17					BTR	DRO		BTR		MRO						
18						DRO		INT		MRO	INT					
19						DRO		BTP		MRO						
20				BTP	BTP					MRO		BTP	BTP			
21								INT			INT					
22					MRO		INT			INT						
23					MRO		MRO			MRO						
24						LTP	LTP	LTP		LTP	LTP					
25						LTP	LTP	LTR		LTP	LTR					
26					MRO		LTR	LTP		LTR	LTP					
27						LTR	LTP	LTR		LTP	LTR					
28						LTP	LTR	LTP		LTR	LTP					

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BTR	Buccal Translation	BTO	Buccal Torque	EXT	Extrusion
LTP	Lingual Tipping	LTO	Lingual Torque	DRO	Distal Rotation
				MRO	Mesial Rotation

Figure 6: *Movement Record Form.*

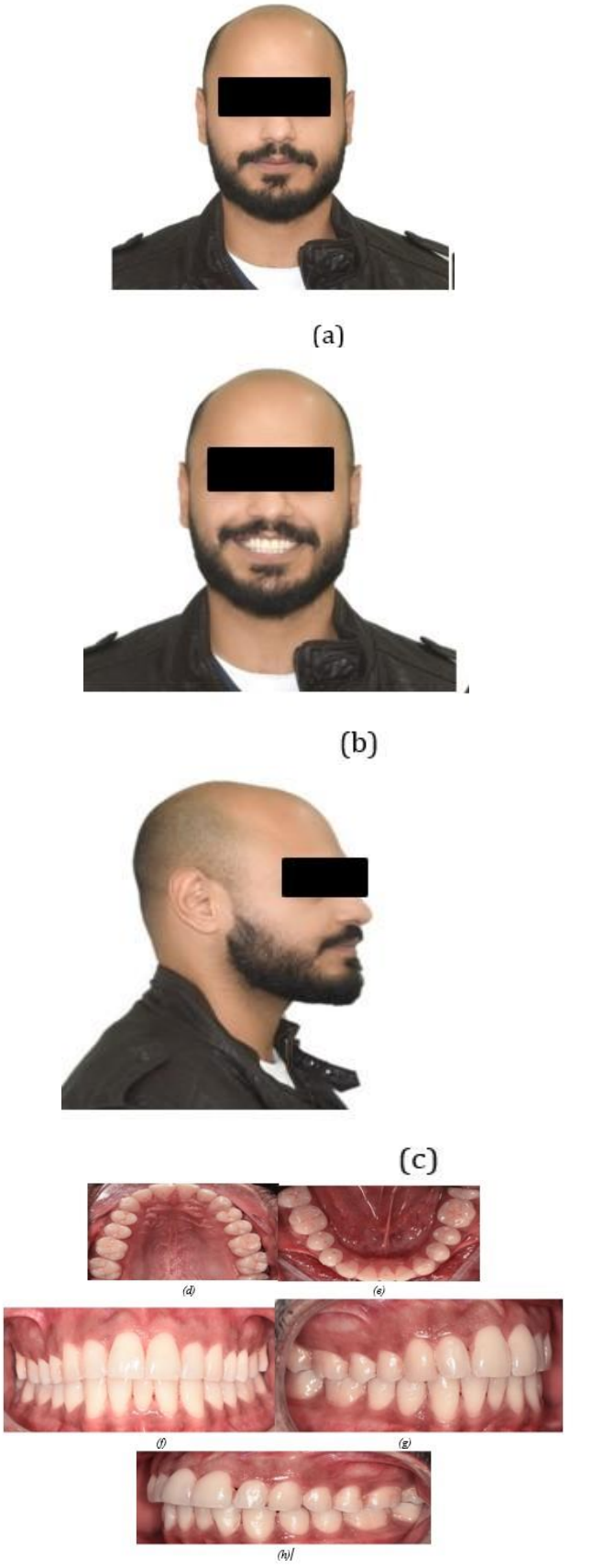

Figure 7: *Post Treatment Records (A), (B), (C) Extra Oral (D), (E), (F), (G), (H) Intra Oral Photographs.*

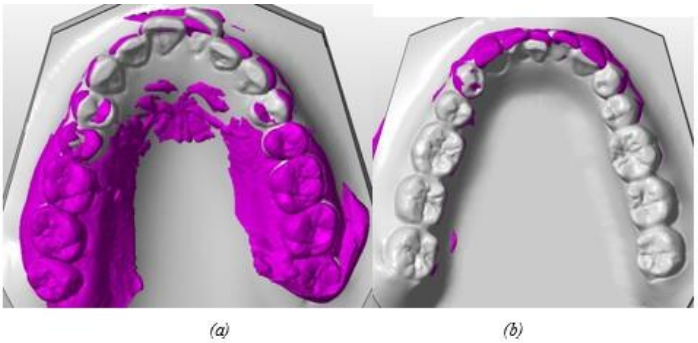

Figure 8: *Superimposition Of Before & After Scans (A) Maxillary (B) Mandibular.*

Treatment Result

The entire treatment course spanned a period of 10 months, with each aligner being worn for a substantial 22 hours per day and replaced every 10 days. By the conclusion of this treatment, the initial crowding issues were successfully addressed, leading to the establishment of Class I molar and canine relationships. The result was the achievement of an ideal overjet and overbite, ensuring proper alignment and bite function.

Furthermore, the treatment concluded with the harmonious centering of the maxillary and mandibular midlines, enhancing both the esthetic and functional aspects of the patient's smile. Importantly, the periodontal health was carefully maintained throughout the treatment, with no evidence of gum recession or the formation of periodontal pockets, ensuring the overall well-being of the patient's oral health.

Discussion

The aim of this study was to evaluate the reliability of resolving crowding issues, the effectiveness of various space-gaining techniques, and their interrelationships in order to establish a dependable protocol for achieving predictable outcomes.

In this specific case involving moderate crowding, clear aligners were successfully employed over a duration of 10 months. Crowding was alleviated through a combination of arch expansion and interproximal reduction. A total of 28 sets of aligners were provided for both the upper and lower arches. While alternative treatment options were presented to the patient, they opted for clear aligners due to their discreet, hygienic, and comfortable nature. Clear aligners represent a unique treatment approach for adult orthodontic patients, addressing aesthetic, hygiene, and metal allergy concerns while offering a treatment duration comparable to traditional fixed appliances [10].

In clear aligner treatment, patient compliance is of paramount importance. Patient education can serve as a motivational tool, influencing patient acceptance of the appliance and improving compliance [11]. In this case, the patient's active involvement and interaction with their orthodontist significantly contributed to the treatment's success. The patient was engaged with the ClinCheck software, which visually demonstrated the anticipated tooth movement and progress throughout the treatment. This

underscores the value of ClinCheck as an educational tool to illustrate the final treatment objectives to the patient.

However, it is worth noting that the clear aligner system does have certain limitations. It may be less predictable in cases involving severe derotations, complex extrusions, or significant translations, which might necessitate additional treatment modalities [12]. Despite potentially higher laboratory fees compared to conventional appliances, the virtual treatment setup, ease of use, and high patient acceptance can often offset the additional cost. This setup not only aids in diagnosis but also serves as an educational tool for patients. Furthermore, patient cooperation is crucial for the overall success of the treatment, which, in this case, was excellent due to the patient's enthusiasm for the process.

Conclusion

In summary, this case study underscores the reliability of orthodontic treatment with clear aligners for addressing moderate crowding. The discreet nature of these aligners not only enhances periodontal health but also increases patient acceptance. Moreover, the precise control of orthodontic movements with minimal risk of losing anchorage makes it a compelling option for clinicians when managing moderate crowding cases.

Consent & Conflict of Interest

A written consent form was signed by the patient for the use of the dental records for publications and social media marketing. Also, there is no conflict of interest with this paper.

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