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Aligners and smile makeovers: The benefits are clear



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Although the benefits of orthodontic treatment are well documented, the adult population has long been resistant to wearing metal braces. Smile makeovers have commonly consisted of masking misalignment with disproportionate restorative material and heavier tooth preparations. The advent of clear aligners, however, has allowed dental professionals to offer a smile makeover that is biological and minimally invasive. Moreover, by utilising technology and a simple 3D scan, it is possible to simulate the end result that patients can expect with different modalities, thus increasing the chances of case acceptance, patient motivation and informed consent.

Introduction

The benefits of orthodontic treatment have long been recognised by dental professionals and patients alike. The need or desire to correct crowded or misaligned teeth dates

back to at least 1000 BCE¹. Generational changes such as ubiquitous marketing, the advent of social media, the 'selfie camera' and, more recently, beautifying smartphone applications have resulted in drastically increased emphasis on having a 'straight, white smile' amongst other aesthetic enhancements².

Adults have generally displayed reluctance to wear braces due to their visually obtrusive nature^{3,4}. Some have instead chosen to undergo restorative dental procedures to mask underlying misalignment or to simply tolerate the misalignment, with many adopting a closed-lip smile and/or experiencing decreased social and psychological well-being in consequence⁵⁻⁷.

The aggressive consumer-facing marketing strategy adopted by Align Technology (San Jose, CA, USA) has seen the number of patients requesting Invisalign treatment rise steadily, particularly in the adult population⁸. Beyond its aesthetic benefits, Invisalign also results in improved patient comfort, reduced pain, better periodontal health, reduced soft tissue irritation and fewer clinical emergencies when compared to braces^{4,9-11}.

When patients present with a desire to improve their smile, it is prudent for the clinician to not only focus on teeth, but also to make a complete assessment of facial aesthetics. Various authors have described many different approaches and landmarks to use when assessing facial aesthetics, perhaps highlighting the subjectivity of the notion of beauty¹²⁻¹⁴.

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Smile design is as much an art as it is a science. The principles of smile design commonly followed by the present authors are as follows:

- Buccal corridors: these are a critical aspect of smile aesthetics, and the aim is to achieve medium corridors where possible (5% to 15% negative space, where 0% refers to teeth filling the buccal corridor);
- Smile cant: to achieve facial harmony, the smile line must coincide closely with the interpupillary line¹⁵;
- Reduction of gingival display: excessive gingival display can detract from an aesthetic smile. Reduction of gingival display can be achieved via intrusion of the maxillary teeth, use of facial injectables such as Botox or fillers in the labia oris elevators, crown lengthening, or a combination of all three;
- Smile arc: where the incisal edges of the maxillary teeth follow the lower lip and have a 'central/lateral step', meaning the incisal edge of the lateral step is 0.5 mm shorter than the central step;
- Golden ratio: the golden ratio of tooth size is followed as closely as possible to achieve visual harmony;
- Facial and maxillary midline: coincident midlines, particularly the facial and maxillary midline, can lead to less distraction of attention to the eye;
- Incisal edge shape: rounded edges generally indicate youth, whereas flatter/square edges indicate wear/age;
- Tooth colour: most patients consider a whiter smile to be more aesthetically pleasing, though this is subjective and should be discussed with patients individually.

Diagnosics and treatment planning

The patient underwent a thorough clinical examination and interview and a complete set of records were taken to help determine potential treatment modalities (Fig 1). Using a digital platform, the patient was provided with several different options which allowed her to visualise the benefits and risks of treatment, as well as the end results (Fig 2).

Clinical examination

The clinical examination showed that the patient had multiple missing posterior teeth and anterior tooth decay. She had recently had her maxillary right first and second molars removed at another practice due to decay. Her periodontal

health was sound and she had no periodontal pockets; however, she had 2 mm recession on the mandibular right central incisor. Her anterior teeth were chipped and showed wear. The patient also had a tongue piercing.

The patient's extraoral facial characteristics were as follows:

- equal horizontal thirds;
- unequal vertical fifths, with the left maxillary region being wider;
- nasal septum deviation to the right-hand side;
- smile line in line with the interpupillary line;
- dolichofacial tendency.

Her perioral facial characteristics were as follows:

- lip canting to the right-hand side;
- maxillary first premolar to first premolar and mandibular second premolar to second premolar visible on smiling;
- 70% maxillary tooth display, 90% mandibular tooth display;
- medium to low lipline;
- maxillary central incisor midlines symmetrical to the facial midline;
- nasolabial line angles wider on the right-hand side, with narrow buccal corridors.

Her dental condition was as follows:

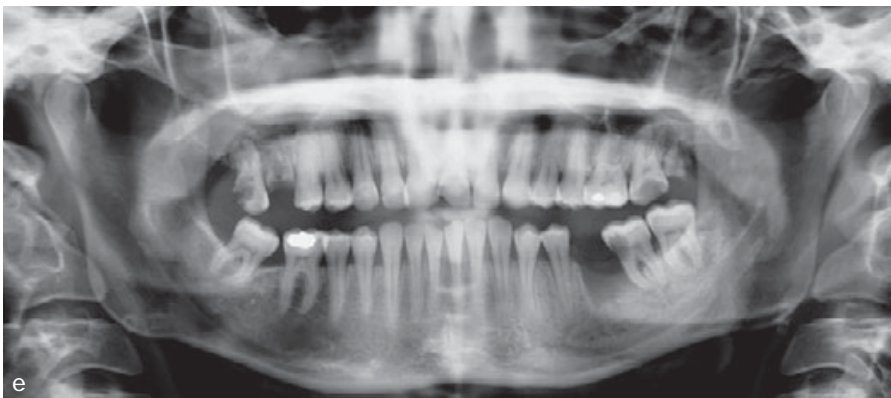
- maxillary and mandibular right central incisors in reverse articulation;
- uneven wear/chipping to the maxillary and mandibular central incisors;
- uneven gingival heights anteriorly;
- recession present on the mandibular right central incisor (2 mm);
- missing posterior teeth;
- periodontal health otherwise sound.

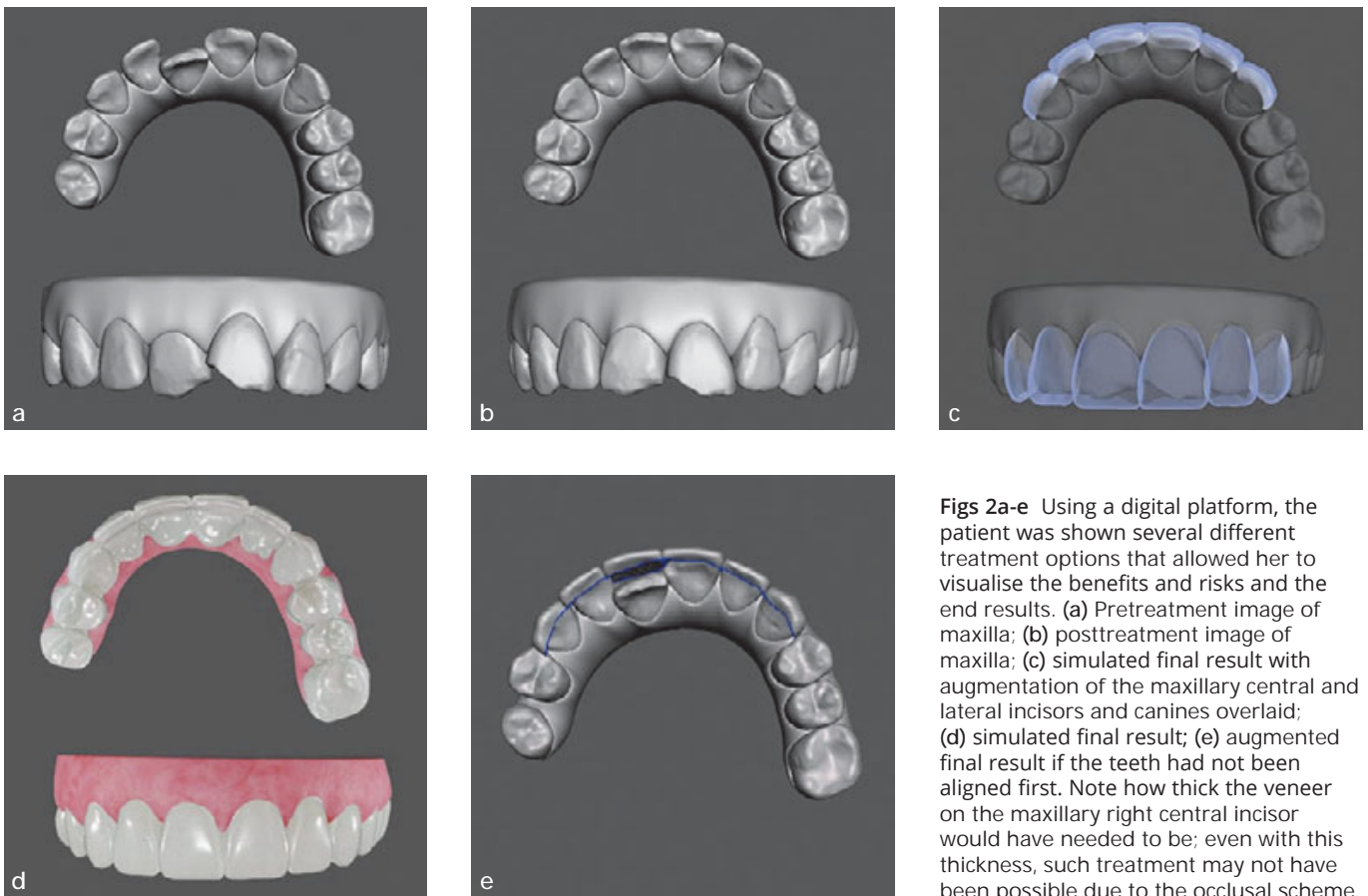
Treatment options

Owing to the anterior reverse articulation, veneers (whether ceramic or composite) were considered unsuitable because of the risk of repetitive fracture due to non-axial loading. The use of third-party orthodontic software tools and simulations helped the patient to convey her concerns and requirements, such as further tooth movement and improvements to the tooth shape, position and colour, golden



Figs 1a-f Preoperative records.





Figs 2a-e Using a digital platform, the patient was shown several different treatment options that allowed her to visualise the benefits and risks and the end results. (a) Pretreatment image of maxilla; (b) posttreatment image of maxilla; (c) simulated final result with augmentation of the maxillary central and lateral incisors and canines overlaid; (d) simulated final result; (e) augmented final result if the teeth had not been aligned first. Note how thick the veneer on the maxillary right central incisor would have needed to be; even with this thickness, such treatment may not have been possible due to the occlusal scheme.

proportions and smile. Additionally, the improvement of bite alignment provided the clinician and patient with confidence that any future anterior restorative work would not be undertaken under concentrated force.

Given the software setup and the presenting complaint, the patient understood the importance of first undergoing orthodontic tooth movement. Gingival heights, ongoing maintenance and the risk of the tongue piercing were discussed. The treatment options offered to the patient were as follows:

- sequential aligner therapy to improve anterior crossbite and overall alignment;
- tooth whitening;
- composite resin Class IV restoration of the maxillary and mandibular central incisors and strategic enameloplasty on the other anterior teeth post-orthodontic treatment;
- composite veneers on the maxillary canines and incisors and the mandibular central incisors post-orthodontic treatment;

- ceramic veneers post-orthodontic treatment;
- gingivectomy to improve gingival heights if required post-orthodontic treatment;
- replacement of posterior teeth.

The patient selected sequential aligner therapy, tooth whitening and ceramic veneers.

Risks and considerations

When embarking on a clear aligner treatment (CAT) plan that applies aesthetic teeth movements, the clinician needs to take into consideration patient consent and understanding of all the treatment options, the importance of compliance, alternative treatment options and side-effects of orthodontic and/or restorative treatment such as recession, increased periodontal bone loss, tooth whitening relapse, maintenance of whitening, lifelong retention, debonding and/or staining of bonding, and risk of pulpal devitalisation.

Treatment with orthodontic aligners

Using Invisalign aligners and with strategic movement velocities, 10-day changeovers, correct attachments and good patient compliance, progress was achieved in 13 months (Fig 3). Prior to and during reverse articulation changes, the patient was made aware that she would experience a period during which she would have an edge-to-edge bite on the maxillary right central incisor and was advised to limit consumption of hard foods during this time. One of the advantages of CAT with anterior reverse articulation is that the plastic in the maxilla and mandible (approximately 0.75 mm per aligner) disengages the teeth, reducing interference during movement. Photographs (Fig 4) and scans were utilised for evaluation and future planning.



Fig 3 Midtreatment frontal intraoral photograph.



Figs 4a-g Posttreatment records.





Figs 5a-e Final records following treatment with anterior e-max veneers.



Restorative treatment

Once alignment was complete, the attachments were carefully removed and the teeth were whitened using Zoom NiteWhite 16% CP take-home whitening treatment (Phillips, Amsterdam, The Netherlands). Options for augmenting the dentition were assessed and simulated using digital software (Meshmixer, Autodesk, San Rafael, CA, USA) and a polycarbonate try-in in the patient's mouth made from a digital wax-up.

A total of six e-max veneers (Ivoclar Vivadent, Schaan, Liechtenstein) were placed using minimal preparation principles on the maxillary canines, and two further veneers on the mandibular central incisors. The patient opted for whitening, ceramic veneers on the maxillary canines and incisors and composite bonding on the mandibular central incisors (Fig 5).

Retention

The retention protocol involved wearing thermoplastic maxillary and mandibular retainers for 3 months on a full-

time basis. The 3-month clinical review showed stable soft and hard tissues, and as such, the patient was moved to nightly retainer wear with the expectation of lifetime retention. The positive anterior vertical overlap also acted as a retention aid.

Conclusion

This case would have been highly challenging and unpredictable had orthodontic treatment not been incorporated. The patient was open to CAT, but stated that she was not interested in fixed braces. Using technology, it was possible to design a stable, functional and aesthetic smile that incorporated a mix of orthodontics, restorative treatment, whitening and routine hygiene. The total treatment time was 16 months and involved a combination of sequential aligner therapy, external tooth whitening, enameloplasty and ceramic veneers. The patient's condition was reviewed after 1 year and was found to be stable.



Declaration

The authors declare there are no conflicts of interest relating to this study.

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