

**CLINICAL
SECTION**

Orthodontic treatment of a patient with a renal transplant and drug-induced gingival overgrowth: a case report

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The treatment of transplant patients is becoming an ever-increasing part of modern-day orthodontic practice. This report details the successful orthodontic management of a paediatric renal transplant patient with significant drug-induced gingival overgrowth. The problems that such patients present with are discussed before considering the specific orthodontic techniques employed. Recommendations are made for practitioners managing such cases.

Key words: Orthodontics, transplants, gingival overgrowth, enamel hypoplasia

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Introduction

Organ transplantation is increasing in prevalence due to improved survival rates following surgery.¹ This has been brought about by advances in tissue typing, improved immunosuppressant drugs, control of opportunistic infections and advances in surgical techniques.² A 95% survival rate following transplant procedures is reported with graft survival rates in excess of 85%.²

A significant risk associated with these procedures is organ transplant rejection. Immunosuppressant therapy is required to minimize host rejection and commonly involves the use of a combination of prednisolone, azathioprine, ciclosporin and more recently, tacrolimus.³

Ciclosporin in particular has had a major impact on graft survival in organ transplant surgery, but its use is associated with a number of unwanted side effects.⁴ These include nephrotoxicity, hypertension, hepatotoxicity, diabetes mellitus and gingival overgrowth.^{2,3} Gingival enlargement secondary to drug therapy is widespread and reports suggest 8–100% of patients taking ciclosporin have this overgrowth, with children and adolescents being more susceptible than adults.^{1,3} The wide range of prevalence reported in the literature is due to variation in assessment of the overgrowth.

Nifedipine is used for these patients to control hypertension and reduce ciclosporin-induced nephrotoxicity.⁵ When used concomitantly however, these

drugs accentuate gingival hyperplasia⁶ and the number of patients with clinically significant overgrowth is reported to be more than double.⁷

This case report describes a case in which a 15-year old girl presented with significant gingival overgrowth following a renal transplant. She was being maintained on a long-term regimen of ciclosporin and nifedipine. Her malocclusion was successfully managed with orthodontic treatment, improved oral hygiene and a concurrent change of medication.

Case report

A 15-year-old Caucasian female was referred to the Orthodontic Department at the Countess of Chester Hospital for an orthodontic consultation. She complained her teeth were small, unsightly and not straight. She was well motivated and very keen for treatment.

History

Her medical history indicated congenital nephrotic syndrome for which she had undergone a renal transplant at age eight. This condition was stable and managed with ciclosporin, nifedipine, azathioprine and prednisolone. She suffered from drug-induced gingival hyperplasia but had no other side effects from her medication. Under the guidance of a consultant in paediatric dentistry, she had undergone a gingivectomy

procedure, by a specialist in surgical dentistry, one year previously, to reduce her gingival enlargement.

Extra-oral assessment

On frontal examination the patient presented with acceptable facial symmetry and balance and acceptable tooth show on smiling. Her dental centrelines were coincident with the mid-facial axis. On three-quarter and profile views, she had average vertical proportions, an average naso-labial angle and her lips were competent at rest (Figure 1a–d).

Intra-oral assessment

Intra-oral examination revealed a very good standard of oral hygiene. Gingival hyperplasia affected the upper and lower anterior teeth. The upper central incisors and canine teeth along with the lower incisors exhibited enamel hypoplasia along the incisal edges. The first permanent molars were also affected. The lower arch was moderately crowded with instanding lower second premolar teeth. The upper arch was mildly crowded. The upper right lateral incisor was instanding and there were mild rotations affecting the upper incisors. In occlusion a Class II division 1 incisor relationship with an overjet of 5 mm was found. The molar relationship was Class I bilaterally and there were unilateral posterior and anterior crossbites without displacement (Figure 2a–e).

Radiographs

Cephalometric analysis confirmed the clinical findings of a Class I skeletal relationship, with an ANB of 2.5° and a Wits measurement of 1 mm, and average vertical proportions (maxillary–mandibular planes angle of 33.5° and lower face height proportion of 58%). The upper incisors were proclined at 119° and the lower incisors retroclined at 83° to the maxillary and to the mandibular planes respectively. Despite the retroclination of the lower labial segment the lower incisal tip was still placed 3.5 mm in front of A–Po line (Figure 3a–c).

IOTN

The dental health component (DHC) of the index of treatment need (IOTN) was 4d and the aesthetic component (AC) was 8.

Treatment aims

These were as follows:

- optimize the gingival health;

- align the upper and lower arches and resolve the crowding;
- correct the anterior and posterior crossbites;
- establish a Class I incisor, molar and canine relationship accepting some mild proclination of the lower incisors;
- arrange for the restoration of the anterior hypoplastic enamel lesions and crown lengthening procedures as appropriate.

Treatment plan

The orthodontic treatment plan involved use of upper and lower fixed appliances on a non-extraction basis. The plan was therefore as follows:

- oral hygiene instruction with dedicated dental education team;
- bond the upper and lower arches with MBT Victory Series (3M Unitek, Monrovia CA, USA) pre-adjusted edgewise appliances (0.022×0.028 -inch slot);
- align and level the arches, correcting the crossbites working up to 0.019×0.025 -inch stainless steel archwires;
- reduce the overjet while maintaining the centrelines;
- detail and finish the occlusion;
- debond and retain.

Treatment progress

Oral hygiene was already of a good standard but given the degree of hyperplasia, oral hygiene instruction and dietary advice was reinforced on a dedicated dental health education clinic. Her plaque index score was reduced from 13 to 1.8%. Informed consent was gained including additional warnings of the possible need to abandon treatment if the hyperplasia worsened significantly; the possibility of a residual overjet post-treatment and the requirement for long-term retention as the lower labial segment was planned to be advanced during treatment.

The upper and lower arches were bonded with MBT Victory Series pre-adjusted edgewise brackets (3M Unitek, Monrovia CA, USA). UR2 was not bracketed initially. Laceback mechanics were placed in the upper right and left quadrants, and 0.016-inch heat-activated nickel titanium (NiTi) wires were used to begin levelling and aligning the arches. The lower arch was progressed to a customized and co-ordinated 0.019×0.025 -inch stainless steel archwire. In the upper arch, a 0.018-inch stainless steel archwire was placed and space opened between UR1 and UR3 with a NiTi open coil spring to allow the UR2 to be bracketed. An auxiliary 0.014-inch



(a)



(b)



(c)



(d)

Figure 1 (a–d) Pre-treatment extra-oral views

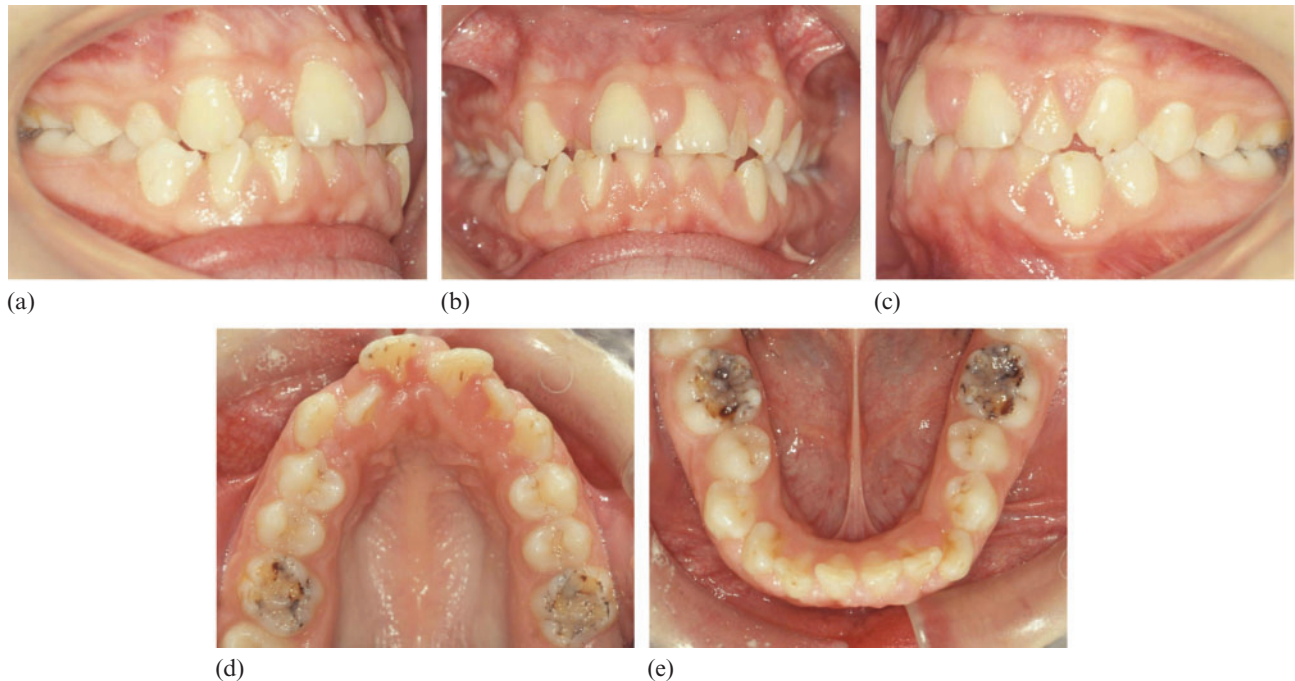


Figure 2 (a–e) Pre-treatment intra-oral views

NiTi archwire could then be placed to allow alignment of UR2.

The oral hygiene remained at an excellent standard, but the gingival hyperplasia was steadily worsening. This was especially evident in the labial segments and on removing the archwire, indentations were noted in these areas. On replacing the archwire, blanching of the gingivae was apparent as the archwire pressed on the gingivae between UR1 and UL1 (Figure 4a–e). The increased risk of decalcification and the need for further surgical intervention were discussed with the patient. She indicated that she wished to continue with treatment but this decision would need to be reviewed periodically.

The upper arch was aligned into a customized and coordinated 0.019 × 0.025-inch stainless steel archwire correcting a small centreline discrepancy with anterior elastic chain and correcting the overjet with Class II elastics, maintaining some lingual crown torque in the lower labial segment.

In light of the worsening hyperplasia, it was felt that although her medical condition was stable, it would be appropriate to consult her general medical practitioner to review her current medication. Her anti-hypertensive medication was changed from nifedipine and substituted with enalapril. Following this her gingival hyperplasia started to resolve.

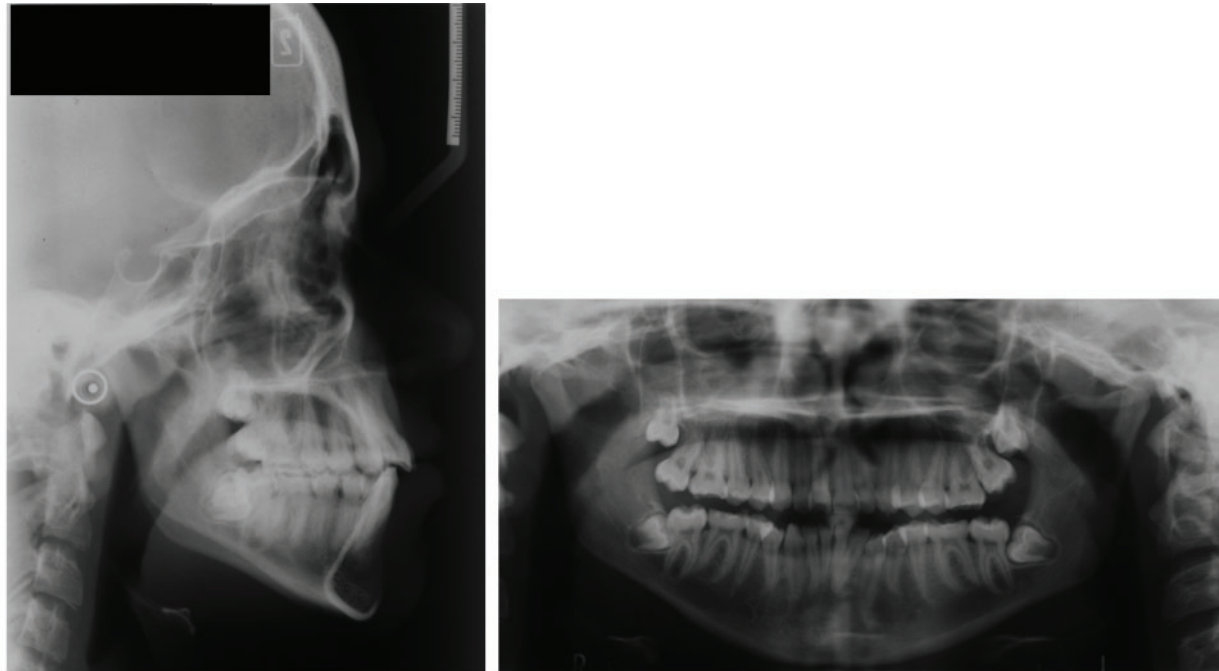
As the gingivae were improving, LR7 and LL7 were aligned into a 0.019 × 0.025-inch stainless steel wire and the upper arch seated to the lower with braided

0.019 × 0.025-inch stainless steel archwires and box elastics. The arches were debonded and upper and lower Essix retainers (Raintree Essix Inc., Metairie LA, USA) were provided to be worn only at night. Instructions were given on the requirement for this to be continued indefinitely. Treatment was completed over 20 months and a good aesthetic result was achieved (Figures 5a–d, 6a–e). It was arranged for composite restorations to restore the hypoplastic lesions in the anterior segments (Figure 7a–e). As the gingival hyperplasia had almost fully resolved and the patient was very happy with the outcome, it was not necessary to consider further gingival surgery.

Discussion

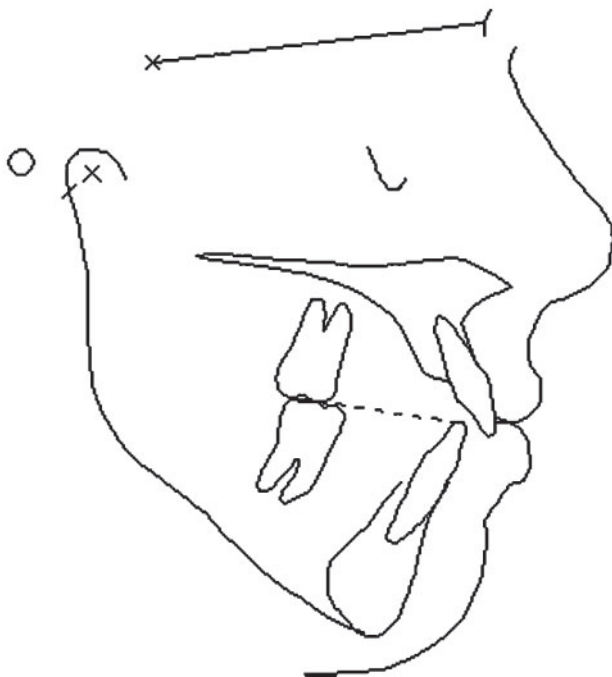
This case report documents a successfully treated orthodontic case in which the patient had significant gingival overgrowth and enamel hypoplasia. Metabolic disturbances associated with chronic renal failure can lead to a chronological enamel hypoplasia of the primary and permanent teeth (sometimes with brown discoloration).^{3,8} This may account for the notching seen on this patient's incisor and canine teeth and the hypomineralized first permanent molars. Non-carious tooth loss can also be seen in this group of patients and may be attributed to nausea, anorexia nervosa or oesophageal regurgitation.³

Treatment was aimed at preventing worsening of the gingival hyperplasia as well as minimizing the effect of



(a)

(b)



(c)

| SKELETAL | | SOFT TISSUES | |
|------------|---------|-----------------|---------|
| SNA | ° 78.5 | Lip Sep | mm 0.0 |
| SNB | ° 76.5 | Exp UI | mm 2.5 |
| ANB | ° 2.5 | LS-E | mm -2.5 |
| SN/MxP | ° 12.5 | LI-E | mm 1.0 |
| MxP/MnP | ° 33.5 | NLA | ° 136.0 |
| LAFH | mm 68.0 | LLA | ° 145.0 |
| UAFH | mm 49.0 | | |
| LAFH/TA FH | % 58.0 | NOSE PROMINENCE | |
| LPFH | mm 35.0 | Nose tip | mm 19.0 |
| UPFH | mm 37.5 | Nose angle | ° 31.5 |
| PFH | mm 67.5 | | |
| Wits | mm 1.0 | CHIN PROMINENCE | |
| | | Chin tip | mm -6.5 |
| TEETH | | B-NPo | mm 1.5 |
| Overjet | mm 5.5 | LADH | mm 40.0 |
| Overbite | mm 1.5 | | |
| UI/MxP | ° 119.0 | | |
| LI/MnP | ° 83.0 | | |
| IIangle | ° 124.5 | | |
| LI-APo | mm 3.5 | | |
| LI-NPo | mm 5.5 | | |

Figure 3 (a-c) Pre-treatment orthopantomograph, lateral cephalometric radiograph and digitized tracing

the overgrowth during treatment. A rigorous oral hygiene regimen was implemented before treatment commenced and this was reinforced throughout with regular dental health educator visits and plaque scores. Inflammation has been shown to play a prime role in

this condition⁷ with the magnitude of adverse gingival changes being reduced when patients enrol on an oral hygiene programme.⁹ This is supported by Chabria and co-workers² who reported that poor oral hygiene exacerbates drug-induced gingival overgrowth

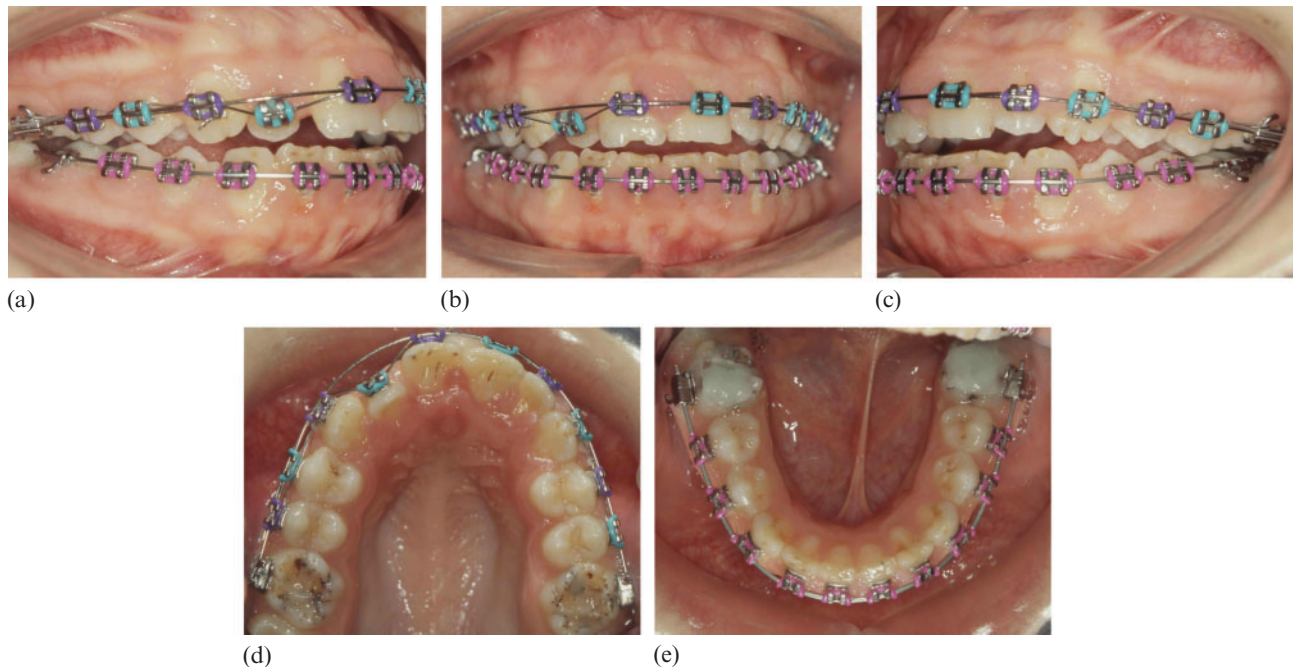


Figure 4 (a–e) Mid-treatment views

expression. It is worth noting however that while stringent oral hygiene measures may reduce the degree of overgrowth,² they do not inhibit its development.^{2,10}

A non-extraction treatment plan was used for this patient even though she presented with occlusal features that under normal circumstances would have necessitated extractions. She had a tenuous overbite, moderate crowding, several hypoplastic teeth and the lower incisors were already ahead of A-Po. It was decided not to extract in case treatment needed to be curtailed due to the medical problems or worsening gingival overgrowth preventing the closure of residual extraction space. Avoidance of space closing mechanics would mean gingival hyperplasia was less likely to counteract orthodontic therapy. This is problematic due to space closing springs impinging upon the bulbous interdental tissue rather than the intended tooth. Furthermore, archwire loops can be displaced buccally thereby altering the direction of intended force. In addition, at various stages in treatment, gingival hyperplasia may engulf and occlude buccal tubes, delay the eruption of teeth and open anterior diastemata.¹¹

With regard to retention, retention clasps of removable appliances may encroach on the hyperplastic gingivae in embrasures so preventing full seating.¹¹

Further measures used in this case included utilizing MBT Victory Series brackets. These brackets are both small and low profile and were therefore intended to aid oral hygiene. Bonded tubes rather than bands on the

molar teeth were used, and all excess composite was removed at the time of bond-up to further simplify oral hygiene.

The treatment plan aimed for a mild advancement of the lower labial segment in order to relieve crowding and this was achieved during treatment. This dictated that a regime of long-term indefinite retention be used. Essix type retainers were used as they impact only minimally upon the gingival tissues. A lingual bonded retainer was not employed due to hygiene concerns in light of any recurrence of the gingival overgrowth.

An important factor in the management of this patient was having a well-organized treatment protocol with liaison between specialties. Prior to referral to the Orthodontic Department, this patient underwent a full mouth gingivectomy. This is however, generally only of temporary benefit² and indeed the overgrowth recurred by the time the patient was initially assessed (see Figure 2a–e).

Assistance was also provided by the patient's physician, changing her medication from nifedipine to enalapril. This eliminated the combined effect of ciclosporin and nifedipine on the gingival overgrowth while adequately controlling hypertension.⁶ Substitution of ciclosporin with tacrolimus (FK506) can also be considered as this reduces the risk of developing gingival overgrowth as well as minimizing its severity in existing cases.^{2,12} Following completion of orthodontic treatment, input was also received from restorative



Figure 5 (a-e) Post-treatment extra-oral views

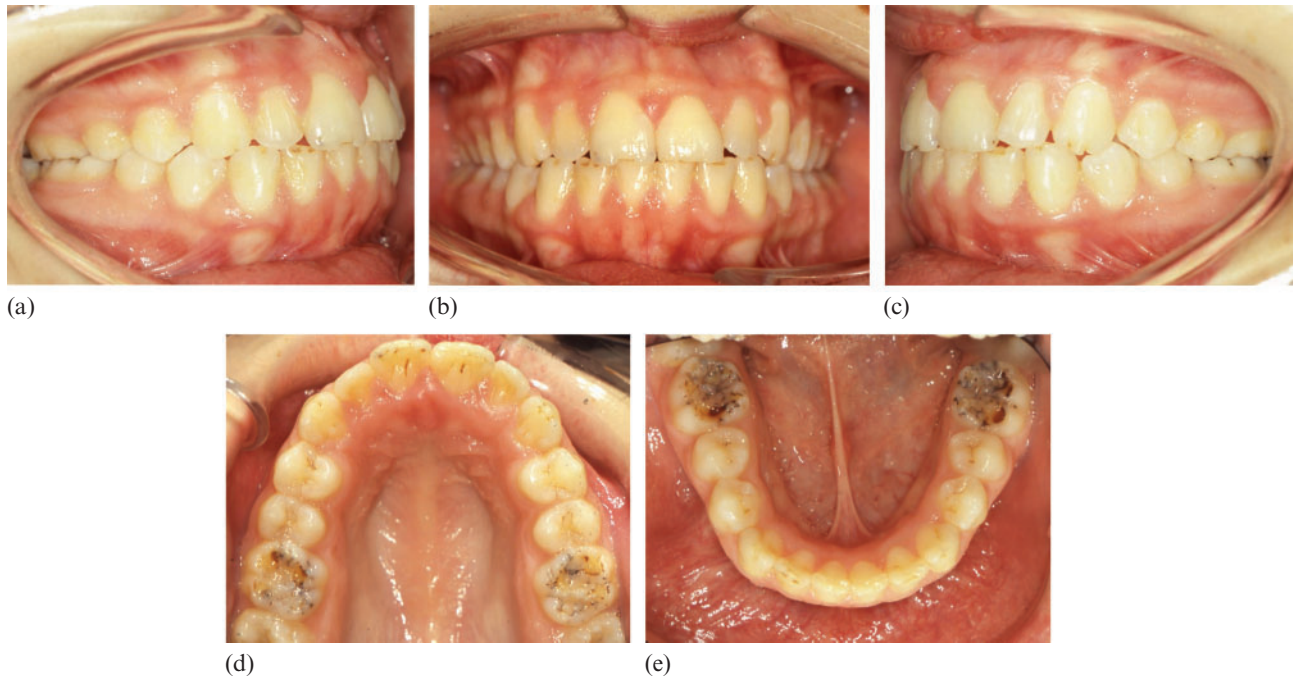


Figure 6 (a–e) Post-treatment intra-oral views

colleagues in addressing the hypoplasia affecting the incisor and canine teeth.

Conclusion

A good occlusal and aesthetic result was achieved for this patient. This was achieved by employing an orthodontic treatment protocol that was tailored

specifically to this patient’s needs and liaison with other specialities. During treatment, oral hygiene was continually reinforced and treatment mechanics adjusted to simplify oral hygiene.

The authors recommend early consultation with these patients’ physicians to explore whether medication can be adjusted to aid control of the gingival overgrowth. Further assistance may be sought from oral surgery

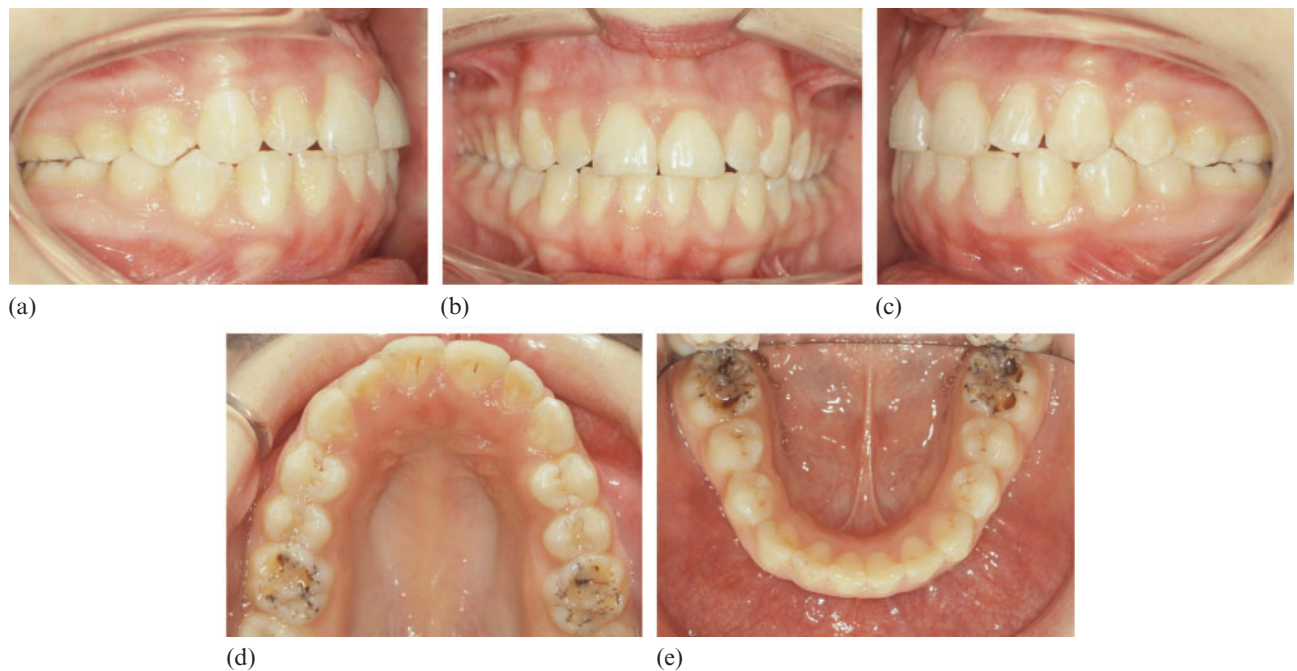


Figure 7 (a–e) Restoration of hypoplastic lesions

Table 1 Key techniques for orthodontic management of patients with gingival overgrowth.

| | |
|---|--|
| Oral hygiene | Dedicated dental health education team Regular reinforcement of oral hygiene instruction Support of dental hygienist |
| Liaison (preferably at treatment planning stage) | Liaise with general medical practitioner/hospital physician Seek assistance from surgical and periodontal colleagues |
| Treatment aims | Simplify aims and avoid extractions where possible |
| Appliance design | Use small, low profile brackets Remove excess composite from around brackets |
| Treatment mechanics | Avoid space closing archwire loops and springs |
| Retention regime | Use Essix retainers relieved around gingival margins Avoid bonded retainers |

and/or periodontology colleagues to perform gingival recontouring procedures.

This case report highlights that even though patients with drug-induced gingival overgrowth present difficult challenges for orthodontic treatment, their management can be successful if the practitioner is aware of the causes of the overgrowth, its control and its implications on treatment mechanics. Techniques suggested within this report can aid orthodontic management (Table 1).

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