

# Management of missing maxillary lateral incisors in general practice: space opening versus space closure

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## Key points

Highlights the main principles considered in the management of mild hypodontia involving the absence of one or more maxillary lateral incisors.

Discusses the arguments of space opening versus space closure in the management of missing maxillary lateral incisors.

Guides general dental practitioners with key points of treatment planning when participating in the restorative management of mild hypodontia cases.

## Abstract

The aim of this paper is to inform the reader of the main principles considered in the management of mild hypodontia involving the absence of one or more maxillary lateral incisors. With increasing demand and limited resources of hospital dental services, general dental practitioners (GDPs) are required to actively participate in the restorative management of mild hypodontia cases. The objectives of this article are to discuss the arguments for and against space opening versus space closure and to highlight key points to consider in treatment planning. The paper discusses advantageous scenarios for both space opening and space closing cases, with the aim of providing the reader with some basic concepts to apply to cases in general practice. Included in the paper is guidance for practitioners on the diagnosis of a missing maxillary incisor via the use of a flow chart and table. It is hoped that this paper will support and enhance the care delivered by GDPs in the restorative management of mild hypodontia patients.

## Introduction

Hypodontia is the term given to describe the absence of one or more deciduous or permanent teeth, excluding third molars. In the UK, prevalence is quoted at around 4%,<sup>1,2</sup> however, this varies from 4.4–13.4% across different continents.<sup>3</sup> The teeth most commonly missing, excluding third molars, are mandibular second premolars followed by maxillary lateral incisors and maxillary second premolars.<sup>3</sup> It has been recognised that there are genetic factors and environmental factors that can contribute to hypodontia, with the former playing a more significant role.<sup>4</sup> Females have been found to be more affected than males<sup>5</sup> and it has also been found that over 49 syndromes have associations with hypodontia.<sup>6</sup> Those with cleft lip and or palate

are also at a higher chance of developing a dentition with missing teeth. Dental anomalies including microdontia, ectopic permanent teeth, transposition of permanent teeth and submerged deciduous teeth are also often found in patients with hypodontia.<sup>4</sup> Missing teeth can impact on aesthetics, function and ultimately self-esteem.

## Classification

In the literature, hypodontia can be divided into mild, moderate and severe cases. Mild and moderate terms are used to describe less than three or less than six teeth missing, respectively.<sup>7</sup> Severe hypodontia is defined as six or more missing teeth, this is also referred to as oligodontia.<sup>8</sup> Anodontia is a term used to describe the congenital absence of all primary or permanent teeth.

Those involved in the multidisciplinary management of hypodontia cases include orthodontists, paedodontists, restorative dentists and oral surgeons. There are three primary treatment modalities in the management of missing unilateral or bilateral maxillary lateral incisors:

1. Accept residual spacing, which may involve retention of the deciduous lateral incisor

2. Close the space, disguising canines as lateral incisors and first premolars as canines
3. Open the space and restore with prostheses.

More recently, it has become common for management of the patient to involve both primary and secondary care. Patients may have treatment planning undertaken in a multidisciplinary environment followed by all or part of the treatment executed in primary care.

## Assessment

Vigilant observation of eruption patterns and, therefore, early detection of missing teeth can aid in the space management of developing dentitions. One would anticipate lateral incisors to erupt between the ages of eight to nine years and failure of this should alert suspicion and warrant radiographic investigation. Premature extractions of primary teeth in crowded jaws may allow some favourable movement of adjacent teeth; however, studies suggest this rarely results in complete space closure.<sup>4</sup> Missing primary teeth is associated with the absence of permanent successors and, therefore, extra vigilance and early referral is recommended.

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If hypodontia is suspected this should always be confirmed radiographically. All missing or ectopic teeth, teeth present and details of any other malocclusions should be noted. The motivation for embarking on orthodontic treatment should also be assessed as well as oral health. A recognised potential implication of missing maxillary lateral incisors is an adjacent ectopic canine.<sup>9</sup> Suspicion of an impacted canine should immediately be addressed with palpation and radiographic examination. Missing lateral incisors would justify an IOTN (Index of Orthodontic Treatment Need) score 4h and along with more extensive hypodontia, a 5h.<sup>10</sup> Additionally, the presence of submerging deciduous molars may generate a 5s score.<sup>10</sup> Figure 1 demonstrates a flow chart to follow if missing maxillary laterals are suspected. Table 1 is an example of a checklist of suitable information to obtain at this visit for inclusion in the referral.

### Accepting the space

Once a missing maxillary lateral incisor has been identified, it is important to discuss this diagnosis with the patient. If the missing tooth and any spacing or malpositioning of adjacent teeth are of no concern to the patient, no treatment and acceptance of the space is a valid treatment option. If this option is chosen, close monitoring should follow until the adjacent canine has erupted to ensure it does not become impacted. A full discussion of the available treatment options and a decision not to treat should be recorded in the clinical notes.

### Space closure

Closing of the space through orthodontic means can minimise the restorative burden and maintains good periodontal health. Excellent aesthetic outcomes can be achieved and studies have reported cosmetic results to be better than that offered by space opening.<sup>11,12</sup> Some clinicians advocate 'ultra-thin' veneers to disguise canines and while these may lead to more refined aesthetic outcomes, they are more destructive and undermine a principle argument for space closure.<sup>13</sup> This should not be routinely recommended and certainly not considered at all until completion of gingival maturation. Though space closure can be achieved by orthodontic, restorative or a collaborative approach, multidisciplinary planning is imperative for successful and

Fig. 1 Suspected missing maxillary lateral flow chart

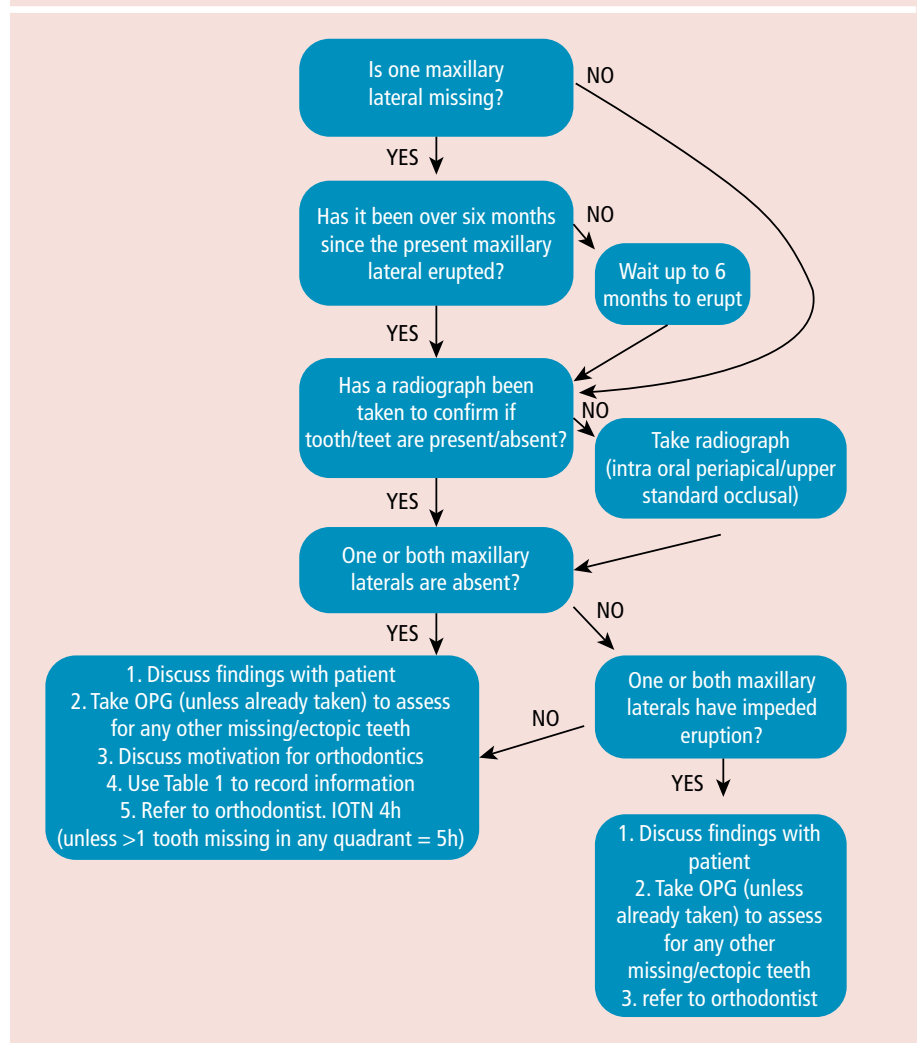
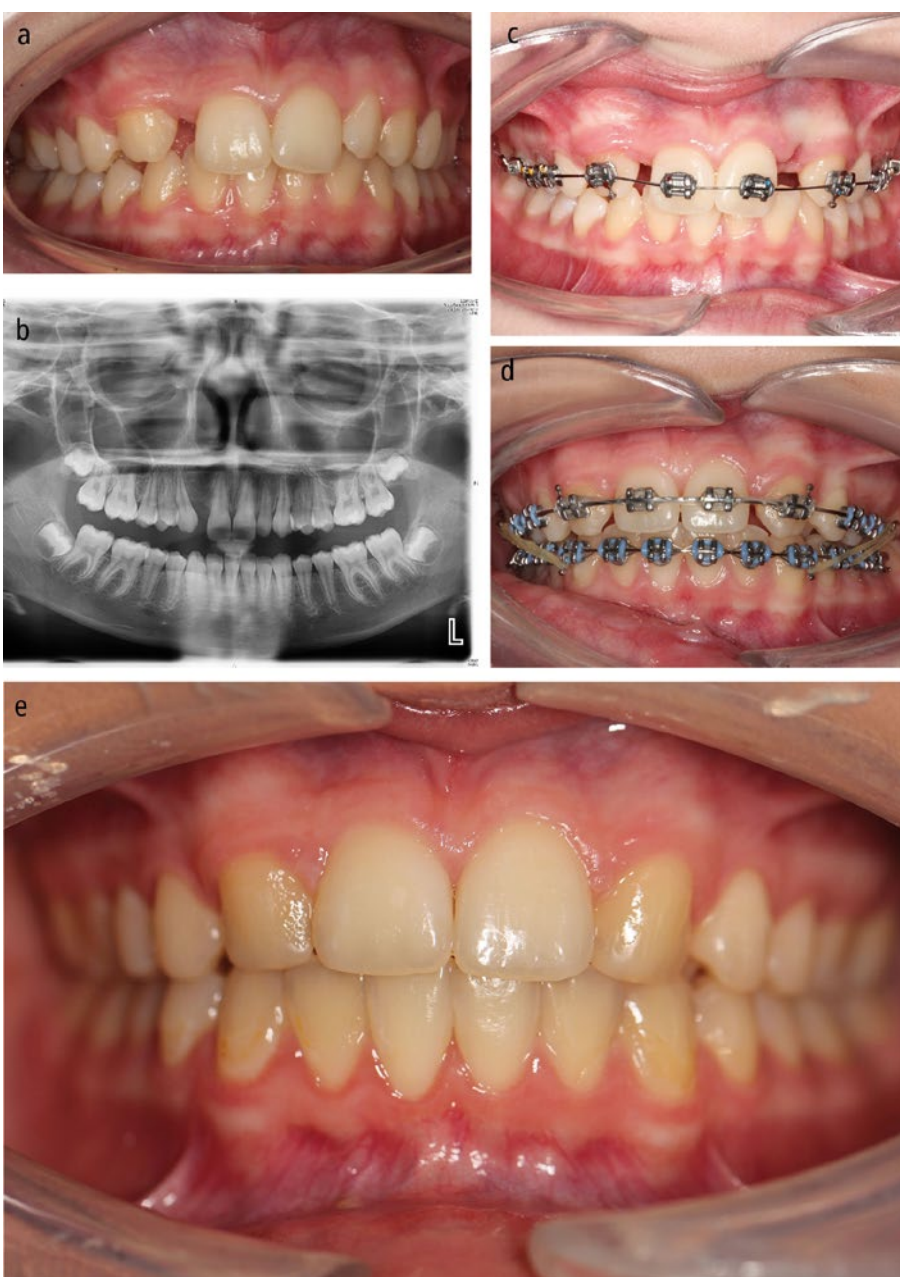


Table 1 Space assessment

Clinical observations	Example
Tooth/teeth missing	22
Space information: location, diameter	edentulous span 21–23, 5 mm
Unilateral/bilateral	Unilateral
Presence of contralateral peg-lateral	12 peg-shaped
Centreline affected? diastema?	Yes, maxillary centreline shifted left 2 mm
Smile line information; high, medium, low	Nil gingival show on smiling
Dentofacial symmetry	Yes
Motivation for orthodontics (yes/no)	Yes
Oral health (caries, periodontal disease)	Nil caries, good bone levels
Family history hypodontia/microdontia?	Not aware of
Canine assessment: restoration status, positioning, angulation of roots, size, width, colour, gingival position	Virgin tooth, compromised camouflage – yellow with high gingival margin
Skeletal pattern	Class II
Crowding?	Moderate
Bone information	Buccal bone palpable

Table 2 Space closure	
Argument for	Argument against
Avoids the need for prostheses	Risk of relapse
Can achieve excellent aesthetics	Aesthetics may be significantly inferior in poorly chosen cases
Shorter orthodontic treatment	If restorative only – small spans only
Minimal restorative intervention	Skeletal class dependent
Improved periodontal health	Lose canine guidance
	Full closure not guaranteed
	Invariably still has a restorative burden



**Fig. 2** a) Pre-treatment intraoral view demonstrating a missing 12 and peg-shaped 22 b) Pre-treatment OPG. c) Patient in upper fixed appliance following extraction of 22 d) Patient in upper and lower fixed appliances e) Post-treatment intraoral view after composite build-up of maxillary canines to mask as incisors

predictable outcomes. As a principle, the argument for space closure is to avoid a long-term restorative burden. Orthodontic alignment should be regarded as the primary treatment, accepting that some restorative modifications may be necessary upon completion of tooth movement. The argument for and against space closure is summarised in Table 2.

Advantageous scenarios for more favourable outcomes via space closure include patients with:

1. Minor spacing, if restorative management only
2. A motivation for orthodontics (caries free and periodontal health)
3. Unfavourable width spacing, necessitating lengthier and more complex treatment (for example, less than half a unit space)
4. A favourable skeletal profile (for example, missing maxillary laterals, Class II Division 1 incisal relationship)
5. Crowding<sup>14</sup>
6. Bilateral missing laterals incisors
7. Favourable aesthetics of canine for camouflage (colour, shape, gingival margin height)
8. Spaces not affecting dental symmetry (if no orthodontic involvement)
9. Small canines unfavourable for adhesive bridge work.

Space closure is further enhanced when the canines are favourably proportioned and both lateral incisors are missing. The masking of unilateral missing laterals can prove difficult. Due to the discrepancy in size, shape and colour of the canine compared to the present lateral, it can be more difficult to achieve a symmetrical, aesthetic result. The present lateral incisor may also require significant restoration. A diagnostic wax-up or Kesling set-up can be advisable at this stage to help visualise possible outcomes (Fig. 2).

**Canine camouflage**

When assessing a canine for its suitability for camouflage, there are four principle obstacles to overcome.<sup>15</sup>

**1. Colour**

Canines often are a different hue to lateral incisors with pronounced differences in value and chroma. Minimally-invasive dentistry should be the mainstay of management and this should be initially addressed with external tray-based bleaching. Single tooth bleaching

trays can be fabricated to prevent unwanted whitening of the central incisors. Patients should be appropriately consented as the whitening process may take several weeks longer. With regards to adolescents, General Dental Council (GDC) guidance states that products containing or releasing 0.1–6% hydrogen peroxide can be used in under 18-year-old patients only for the 'purpose of treating or preventing disease'.<sup>16</sup> The unfavourable aesthetic of a canine masking as a lateral incisor is arguably not disease but normal anatomy. There are, however, a number of negative psychosocial effects that the discolouration can have on an adolescent including negative self-image, bullying and the emotional distress of delaying treatment to adulthood.<sup>17</sup> The use of bleaching to treat unaesthetic, camouflaged canines can eliminate these effects and negate the need to enter the restorative cycle with more invasive treatment, as discussed later in this article.

### 2. Length and width

Canines are wider and longer than lateral and central incisors. Interproximal reduction can be undertaken during orthodontic treatment with an ideal endpoint aiming for a tooth slightly narrower than the central incisor. The orthodontist should aim to correct the gingival zenith to sit distal to the midline and around 1 mm beneath the zenith of the central incisor. This may leave the canine tip significantly lower than the central incisor and it may be necessary for the orthodontist to reduce the canine tip as the tooth moves bodily. The proposed incisal level should be slightly below that of the central incisor.

### 3. Shape

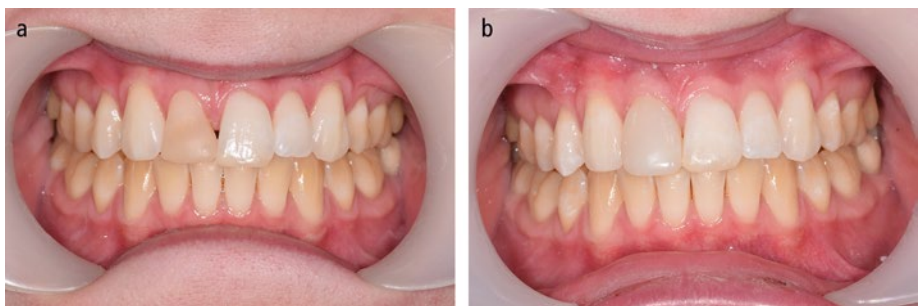
Canines are invariably more pointed than incisors, even once the proportions have been reduced. Correction of this will require the direct addition of composite to square-off the mesial and distal incisal corners. This can be facilitated with a diagnostic wax-up used to create a matrix allowing ideal palatal contour before veneering composite buccally. Readers are referred to other papers on composite techniques for more information.

### 4. The first premolar

This tooth will become the canine. As first premolar teeth have a palatal cusp and are narrower than canines, they may need adjusting. This could be as simple as a slight reduction of the palatal cusp, however, the



**Fig. 3** a) Pre-treatment intraoral view shows both missing laterals in the maxilla and pointed canines. There is also a missing incisor in the mandible b) Results at debond after planned space closure undertaken, note the canines are pointed, despite being modified during orthodontic treatment, and the centrals asymmetrical c) Intraoral view following replacement of the 31 with an adhesive bridge, shape modification of the centrals and laterals and direct composite veneers to the canines and centrals d) Extraoral view post-treatment. While this patient has clearly undergone operative dentistry, it would be hard to spot these as canines



**Fig. 4** a) Patient with 11 missing. Space closure was undertaken with a view to disguise the lateral as a central and the canine as a lateral b) Intraoral view shows the canine was reduced in both length and bulbosity and a composite veneer added to the 11 though far from perfect this is a significant improvement and the patient was very happy

addition of composite to the mesio-buccal aspect may be required to replicate the bulbosity and contour of a canine.<sup>18</sup>

### Orthodontic aspects of space closure

Space closure, to bring the canines forward to mask as the missing lateral incisors, is usually achieved with upper and lower arch fixed appliances. The space closure usually also involves the use of intra-maxillary springs or elastic power chain and/or inter-maxillary elastics. The favourable skeletal profile for space closure of missing lateral incisors is Class II, usually along with an increased overjet that would benefit from reducing into a class

I incisor relationship. Canine guidance is not possible when canines are moved to the lateral incisor position and therefore the occlusal aim is to achieve anterior group function. Also, tooth movement may be slow and occasionally it may be difficult to fully close the space. This is often due to alveolar bone narrowing and therefore it is harder to move teeth into the shallow bone volume. There is, however, with all orthodontic treatment, a risk of relapse and good retention needs to be employed after the completion of the active phase of orthodontic treatment.<sup>19</sup>

From an orthodontic point of view, the aim should be to torque the canine root palatally, reducing the canine eminence and place the



**Fig. 5** a) Pre-treatment intraoral view, showing spaces present in the upper arch due to missing maxillary lateral incisors b) Orthodontic fixed appliances were placed to open the space for the missing upper laterals and moving the upper canines in a class 1 position c) End of orthodontic treatment before restorations being placed d) Post-treatment intraoral views showing the placement of RBB for the missing upper laterals

is not tooth fracture, caries or pulpal death, as would be anticipated with traditional dentistry, but rather staining and fracture of composites; problems which can be more easily rectified. If compared to more traditional class III and IV cavities, annual failure rates are reported to be 0.6% and 4.1% (Fig. 4).<sup>21</sup>

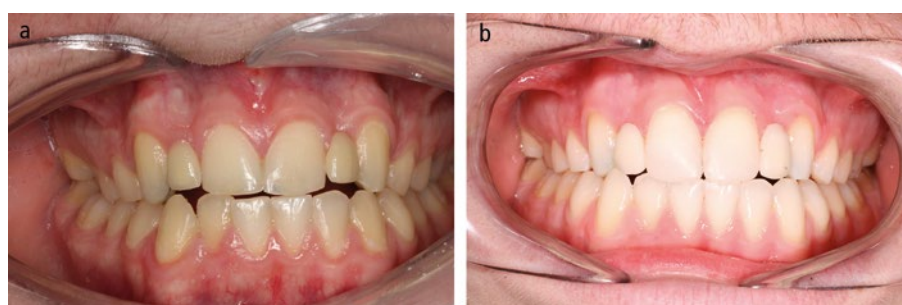
If a patient is not motivated for orthodontic treatment, small spaces can be closed or reduced with restorative intervention. This can be achieved using composite additions or with more invasive, indirect prostheses, for example, veneers or crowns. Attempts to close larger gaps with restorations can deliver poor aesthetic results such as, broad ‘tombstone’ teeth. Fundamentals of smile design should be employed when treatment planning with restorative camouflage.<sup>22</sup>

### Space opening

An alternative treatment option to manage spaces created by missing laterals is to increase or manipulate the space/spaces to allow aesthetic restoration with a prosthesis (Table 3). Space opening is only an option for those patients motivated and suitable for orthodontic treatment. The aim of opening or adjusting space in the maxillary lateral region is to create a single unit space to permit like-for-like replacement of the missing tooth. It is biologically desirable to maintain or create canine guidance to protect the future prostheses. Advocates of space opening would argue that canine guidance is a more favourable functional outcome and more predictable in the long-term. In addition, prosthetic laterals have superior aesthetics to that of camouflaged canines. Clinicians must recognise, however, that space closure is not always possible and alternative strategies will be needed.<sup>23</sup> The arguments for and against space opening are summarised in Table 4.

Advantageous situations for more favourable outcomes via space opening/alteration include patients with:

1. Single missing lateral with/without peg-shaped contralateral incisor
2. Sufficient enamel on abutment tooth for bonding (if adhesive bridge planned)
3. Sufficient bone for implant/retained maxillary deciduous lateral incisor (if implant retained prosthesis planned)
4. Large or uneven sized spans (for example, 3/4 unit)
5. A motivation for orthodontics (caries free and periodontal health)



**Fig. 6** a) Pre-operative view of patient presenting as an adult following orthodontic treatment and adhesive bridge placement in their teens. This is clearly an example of a sub-optimal outcome b) Post-operative view after orthodontic refinement, whitening and new adhesive bridges

**Table 3** Prosthodontic options to replace absent lateral maxillary incisors and their success rates

Restorative solution	Expected success rates	Mode of failure
Dentures		Functional and psychological expectations unmet
Adhesive bridges	87% at five years <sup>30</sup>	Debond
Conventional bridges	94-89% at five to ten years <sup>31</sup>	Pulpal death, recurrent caries or catastrophic failure
Implant-retained single crowns	95-89% at five to ten years <sup>31</sup>	Biological, technical or aesthetic failure

canine root similar to the position that should have been occupied by the permanent maxillary lateral incisor. Other orthodontic movements may include extrusion of the canine to allow the gingival margins to migrate down to mimic that of a lateral incisor and mesial rotation of the first premolars for aesthetics (Fig. 3).

There is very little data on the longevity of direct bonded restorations to modify canine and premolar shape, but the survival of anterior composites when used to manage tooth wear is very good, with some evidence of failure emerging after around five to six years.<sup>19,20</sup> It must be remembered that failure in this context

6. Spaced dentition
7. Class III skeletal profile
8. Canine shape and size unfavourable for camouflage.

The ambition of space opening treatment plans should be to create space appropriate to accommodate a lateral incisor proportionate to the central incisor. Around 7 mm is usually the optimum sized space but this may need to be reduced proportionately if the centrals are diminutive but well-proportioned. If the planned restorative solution is dental implants, then a minimum space of 7 mm should be achieved in both intra-coronal space and intra-radicular space. The centrals should also be assessed whereby the width of the crown should be around 80% of the length. If this is not the case, restorative modification of the centrals may need to be factored into the final treatment plan or the shape modified mid-orthodontic treatment.

The average central incisor is 10–11 mm x 8–9 mm. Often in hypodontia cases, incisors are poorly proportioned and narrower. If, for example, the incisor is 11 mm in length but only 7 mm in width, the orthodontist should aim for an 8 mm space in the lateral position to accommodate the addition of composite to the centrals as well as the prosthetic lateral. The same may be said of canines; often these teeth benefit from the addition of composite to improve the proportions. Prior to the debond appointment, it is recommended for the dentist providing restorative treatment to review the spaces that have been created. This is an opportunity to revisit the initial treatment plan and compare this with the orthodontic result achieved (Fig. 5).

Once a suitable sized space has been created, options for restoring the space can be in the form of a removable prosthesis, conventional or adhesive bridgework, autotransplantation or an implant-retained prosthesis. Partial dentures, although not often the preferred choice, can be a fast and straightforward treatment option to replace missing maxillary laterals. They also provide the flexibility to alter face height and act as space maintainers in interim treatment planning.<sup>15</sup> An orthodontic retainer with laterals incorporated gives immediate rehabilitation and allows time for space assessment and planning. This may be in the form of a traditional Hawley or Essix retainer.

If considering bridgework, it is important to have a thorough assessment of abutment teeth.

**Table 4** Argument for and against space opening

Argument for	Argument against
Aesthetic result for larger spans	Requires patient to enter into restorative cycle
Possible to maintain canine guidance	Long-term prosthesis management, including financial implications
If canine unsuitable for camouflage	Loss of bone
	Lengthier orthodontic treatment times



**Fig. 7** a) Pre-operative view of patient with both missing laterals and diminutive canines b) Space optimisation and modification of the canines and centrals with composite c) Post-operative views with adhesive bridges fitted

Conventional bridgework should remain a discussion item in consent terms but should be avoided unless the canines are heavily restored and protection of remaining tooth structure is sought. In addition, the likelihood of pulpal death is very high in young teeth.<sup>24,25</sup> Resin-retained bridges are the bridge of choice yet require sufficient enamel on which to bond for a predictable outcome.<sup>26,27</sup> In these authors' opinion, the canine should be the tooth of choice as there is invariably a good surface area for bonding and the depth of dentine is usually sufficient to prevent metal show through, which may compromise aesthetics. Excellent long-term retention is essential as de-rotation of the canine may result in compromised aesthetics later in life (Fig. 6).

Short clinical crowns and microdont teeth can restrict the amount of palatal enamel for bonding.<sup>15</sup> It is possible however, to increase the amount of enamel available using electrosurgery or formal crown lengthening.<sup>9</sup> The central incisors may be used as abutments yet can be prone to greying of the abutment, resulting in compromised cosmetics. In addition, the alveolar ridge should be examined when deciding upon the shape of the pontic. Site preparation with electrosurgery or a high speed handpiece with a round coarse diamond bur can help develop the future pontic site and encourage a more natural emergence.<sup>28,29</sup> Using such techniques can ensure good aesthetics and high success rates at five and ten years. Although the success rates of adhesive bridges may appear lower than those of dental implants, one must

remember that resin-bonded bridges offer a simple, inexpensive and elegant solution. The biggest consequence of failure is the embarrassment between bridge debond and the emergency recement rather than the costly and labour intensive prosthetic and biological complications associated with implantology (Fig. 7).

Implants can offer an alternative solution in cases where dentures or adhesive bridgework are unsuitable or not desired. Implants are usually limited to those over 18 years of age, following the majority of craniofacial growth. Patients considering this treatment option must have a full assessment of the amount and quality of bone, as well as the angulation of the adjacent teeth and their roots. Due to the lack of alveolar bone in the edentulous span, it is often necessary for bone augmentation in hypodontia cases.<sup>15</sup> Nonetheless, the implant solution is independent and fixed. It also allows restoration of the space with residual spacing if necessary.

Though the implant-based solution is often seen by patients and clinicians alike as the treatment ambition of choice, the lifetime burden of maintenance may leave adhesive bridges the most predictable options. While survival rates of implant-retained crowns are high, this does not represent any biological or technical complications that can often occur over the implant lifespan.<sup>32</sup> It implies survival rates to be equivalent to success rates, perhaps ill advising patients of the potential problems encountered with implant upkeep, which often involve significant costs.

## Summary: key points

As a GDP, when diagnosing missing maxillary lateral incisors or when assisting in their management it is important to abide by the following practices:

1. Be vigilant with eruption patterns
2. Refer early
3. Reinforce importance of exceptional oral hygiene
4. Use diagnostic wax ups
5. For space opening cases, review the patient before debond to reassess and adapt treatment plan if necessary
6. Remember planning and good liaison is key!

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