Enhanced CPD DO C

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Clinical Tips to Improve the Restorative Management of Hypodontia: Part 1

Abstract: Hypodontia is defined as the developmental absence of one or several teeth. Management of these cases can appear to be complex, but many aspects of the treatment could be managed in primary care. This article aims to enhance understanding and improve confidence in managing hypodontia cases in an appropriate way. This article is the first part of a two-part series providing clinical tips to improve the restorative management of hypodontia.

CPD/Clinical Relevance: Many aspects of hypodontia can be managed effectively by interested and experienced GDPs who wish to treat suitable cases, while more complex cases can be referred for management by multidisciplinary teams in secondary care.

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Hypodontia is defined as the developmental absence of one or several teeth. It can be further subcategorized into oligodontia and anodontia. Oligodontia is a term that is often used in cases with more than six missing teeth. Anodontia is a rare condition characterized by the absence of all of the adult teeth.[1] The prevalence of hypodontia is estimated as being between 0.1% and 0.9% in the primary dentition and between 3.5% and 6.5% in the secondary dentition.[2] The aetiology of hypodontia is multifactorial although often follows a polygenic mode of inheritance.[3] Patients with hypodontia can pose a range of challenges, but interested practitioners can help to achieve predictable, functional and aesthetic treatment outcomes for many of these patients.

General dental practitioners (GDPs) have an important role in the early diagnosis and possible referral to secondary care for advice or further treatment. Experienced practitioners can certainly manage many cases, and most GDPs should feel able to help with long-term maintenance.

Features of hypodontia

Common features of hypodontia include:[3]

- Absence of maxillary lateral incisors;
- Absence of mandibular premolars;
- Microdont maxillary lateral incisors often with absence of the contralateral tooth;
- Smaller-sized teeth in the remaining dentition;
- Small-rooted teeth.

Hypodontia is frequently found in certain genetic syndromes, such as Down's syndrome and ectodermal dysplasia.

It is important to treat hypodontia in a timely manner. Figures 1 and 2 show a patient with hypodontia who was left untreated.

Clinical challenges

Clinical challenges that need to be addressed when managing patients with hypodontia include:

1. When to refer to secondary care and the timing of interceptive treatment;
2. Making decisions about whether to open or close spaces;
3. Managing tooth size discrepancies, shades and positions (maxillary canines and microdonts);
4. Resolving issues about the design, materials and timing of resin-retained bridges (RRBs);
5. How to manage missing mandibular premolars;
6. Retention or removal of deciduous molars;
7. Managing infra-occlusion;

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Figure 1. Untreated hypodontia case with a diminutive UL2, a mesially inclined, yellower canine and infra-occluded deciduous second molars in both jaws.

Figure 2. Untreated hypodontia with infra-occluded deciduous second molars in both jaws and a dark-coloured canine

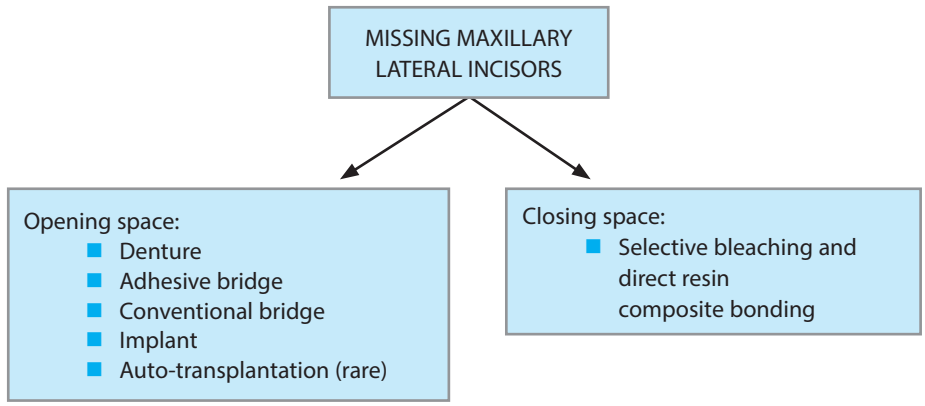

Figure 3. Flowchart demonstrating an overview of the options for closing or opening spaces when maxillary lateral incisors are missing**.**

8. Timing of implant placement and the appropriateness of this treatment option;
9. Issues around long-term orthodontic retention/relapse.

Clinical tips for challenges 1–3 are covered in this part of the series, while challenges 4–9 are covered in the second part of the series in the following *Dental Update* issue.

When to refer to secondary care and the timing of interceptive treatment

A multidisciplinary approach is often indicated to manage hypodontia cases predictably. In hypodontia cases, it is valuable to have input from paediatric, orthodontic, restorative and oral surgery colleagues at the appropriate times. It is also important to maintain regular communication between the referring GDP and the multidisciplinary team.

An orthodontic referral is indicated in most cases of hypodontia, especially if hypodontia is obvious in the deciduous dentition.[4] In 2006, the British Orthodontic Society (BOS) produced a scoring index to prioritize orthodontic demands within the National Health Service (NHS), which is known as the Index of Orthodontic Treatment Need (IOTN).[4] This index has two components:

- The dental health component (DHC), which is graded from 1 to 5 (indicating least to most severe).
- The aesthetic component (AC), which is graded from 1 to 10 (indicating least to most severe).

If a patient is under the age of 18 and has an IOTN with a DHC of grade 3 or above, and an AC of grade 6 or above, treatment is funded within the NHS at present.[4]

Orthodontic treatment is usually fairly acceptable for most children, with their parent/guardians having few problems accepting treatment. However, the parents and patient need to be made fully aware of the limitations of orthodontics, the need for co-operation and compliance with advice, and the maintenance of excellent oral hygiene throughout treatment. They also need to be warned about the instability of teeth that are moved orthodontically and the probable need for indefinite retention.

In adults, orthodontic treatment might not be a viable treatment option for various reasons. A common presenting complaint in adults with hypodontia is spacing due to missing teeth. Spacing within an arch can be managed using orthodontics, or in other restorative ways, such as with the use of direct resin composite bonding, RRBs or with dental implants. A combination of restorative and orthodontic treatments may be appropriate. Prior to undertaking any irreversible procedures, it is important to have detailed discussions with any adult patient regarding their various viable treatment options in order for that patient's consent to be considered valid.

Making decisions about whether to open or close spaces

Missing maxillary lateral incisors constitute 20% of all missing permanent teeth.[5]

The decisions as to whether to close or open the lateral incisor space remain contentious. The final decisions are dependent on such variables as skeletal pattern, tooth size, root angulations and numerous other subjective variables, including the available skills of clinicians and technicians, as well as financial resources.[5,6] Those individual nuanced decisions will usually have an influence on the practical management that is indicated, and often will affect whether treatment is performed in primary or in secondary care. An overview of options for opening/closing spaces in the case of lateral incisors is shown in Figure 3.

Managing tooth size discrepancies, shades and positions (maxillary canines and microdonts)

Tooth size discrepancies are a common clinical problem in hypodontia. Following space closure, canines and microdonts can be modified with direct resin composite to achieve acceptable shapes.[7]

Careful consideration of the canine and its suitability to camouflage as a lateral incisor is crucial to provide the patient with sufficient information before making their decision about their treatment options.

A maxillary canine is rarely the same colour as a central incisor (Figure 4). This is a result of the greater bulk of yellow phosphoprotein in the dentine and the much wider, labially convex and pointed shape. As a result of the increased amount of this phosphoprotein, it takes longer to bleach the bulkier canines and premolar teeth than the much flatter incisors. As a consequence, the canine and premolar teeth ought to be bleached first and separately from the incisor teeth to avoid causing a worse colour discrepancy unintentionally (Figure 5).

One important clinical tip for managing the colour discrepancy with the maxillary

Figure 4. Canines are a yellower shade than incisor teeth due to the bulk of yellow phosphoprotein present in the dentine (UR3, LR3) and they ought to have been bleached separately. The failure to do so here contributed to a poor outcome.

Figure 5. This patient had refused orthodontic intervention. The left maxillary canine had drifted in to the position of the lateral incisor. Both the canine and premolar were bleached selectively to be the same colour as the incisors prior to further treatment.

canine is to prevent the concurrent bleaching of the maxillary central incisors by using a customized bleaching tray. A window can be cut at the tray fit appointment over the labial aspect of the neighbouring teeth that do not require bleaching to avoid patients inadvertently bleaching them. Reducing the number of visible colour changes draws less attention to the dentition and mouth.

If an RRB option is chosen, the canines should be bleached separately to be as close as possible to the colour of the central incisors before taking the shade for the adhesive bridge so that 'the social six' demonstrate better uniformity. If the canines alone, or the canines and premolars are to be bleached, then nightguard vital bleaching, using 10% carbamide peroxide, can be done using a customized bleaching tray with labial reservoirs (Figures 6 and 7).

Overcoming the problem of orthodontic resin retention in enamel

After orthodontic bracket de-bonding, it is important to check for the presence of residual composite left on the teeth where the brackets were placed. A common practice is to 'click off' the brackets, which can leave residual composite bonded to the top layer of enamel as seen in Figure 8. Any residual composite tags will prevent the hydrogen peroxide penetrating the enamel in that area and consequently the teeth will not bleach there.[8]

Figure 6. The canines and adult first premolars on both sides were selectively bleached to be roughly the same colour as the unbleached central incisors.

Figure 7. A direct cantilever adhesive bridge retained by the left first premolar, along with direct freehand composite bonding helped to conceal the missing lateral incisor problems. The patient was warned in advance that the result would be 'neither permanent nor perfect' but it would probably be a 'modest improvement'.

Figure 8. The resin composite tags left in the enamel after removal of orthodontic brackets will stop bleaching of the canines and premolars in those regions

If there is any doubt about residual orthodontic resin composite being retained in the enamel, then a useful tip is to 'check-etch' the teeth with 37% phosphoric acid gel. The etching gel can be left in position for 15 seconds and aspirated away. Once most of it has been aspirated then the areas can be washed and dried thoroughly. Any areas that do not have a frosty appearance still have up to 50 microns of resin composite tags in the inter-prismatic areas. This ought to be removed gently with a dry tungsten carbide finishing bur, such as a Jet FG7901 bur (Henry Schein, Melville, USA) or a small Soflex disc (3M ESPE, Seefeld, Germany).

Gingival height assessment

One should assess the gingival heights of the two central incisors and ensure the apical position of the replacement pontic match these. If there is a discrepancy between the gingival positions of the central incisors, this can be modified to appear to be parallel to the interpupillary line – the so-called gingival aesthetic line. Gingival tissue may also need to be removed surgically to alleviate this discrepancy, but only after detailed discussions and obtaining valid consent.

To assess how much gingival tissue requires removal, one can temporarily cure direct composite on to the dried enamel (ie not etched enamel), and extending this over the gingival tissue allows the patient and the treating clinician to assess whether a significantly improved outcome would justify the potential periodontal surgery.

If there is a wide band of keratinized tissue present, there is potential for the gingival position to be modified with an internal bevel incision or with a soft tissue laser, following the agreed outline created by the temporary composite mock up. The composite can then be flicked off the dried enamel and the area allowed to heal.

Laboratory wax-ups and other visualization techniques

Laboratory-based diagnostic wax-ups on plaster models can be prescribed as a traditional reference tool. However, many patients do not have the same level of visualization skills as many experienced dentists. Some patients have great difficulty in assessing a laboratory-made wax-up, particularly if it is produced in a bright green- or blue-coloured wax.

An alternative method involves the use of direct resin composites sculpted on to unetched teeth. This can quickly allow the patient and/or their parent/guardian to visualize the proposed final result. Such a readily reversible approach allows enough time for assessing the reactions of both the patient and their parents.

A photograph of the *unfinished* composite can be taken on a patient's phone and another can be taken by the treating clinician and used as a reference before then flicking the composite mock-up off. This can be useful in decision-making and consent processes.

Managing expectations of outcome early on

The outcome of hypodontia, even after considerable skill is employed, is never 'perfect'. Patients and parents need to be given and understand that message early on in the treatment planning stage. Any mention of the word 'perfect' or 'permanent' by a patient or parent should be immediately challenged, because it is extremely unwise to allow that expectation to continue. It is far more sensible to under-promise and over-deliver than it is to do it the other way around.

Figure 9. Post-orthodontic treatment using space closure. The canines were taller, yellower and bulkier in appearance than the central incisors and the incisal tips were the incorrect shapes to resemble a lateral incisor.

Figure 10. Post-treatment position. Selective bleaching and direct resin composite were used to try to mask that the maxillary canines were in the wrong position and both maxillary lateral incisors were missing. The result was orthodontically stable and maintenance costs should be minimal.

Not challenging patients who have unrealistic expectations early on is imprudent. Many patients would not commit to a vast amount of treatment if someone in the team told them those clinical facts early, rather than allowing their expectation of perfectionism to flourish. It is true that one can mitigate the problems of hypodontia at various costs, using different technologies and over various time scales, but one needs to be aware of the frequent instability of the outcome because many factors are outside the clinician's control, such as the patient's oral hygiene, their diet, their clinical co-operation and compliance in the use of headgear and their growth or genetics.

Closing maxillary lateral incisor spaces and canine modification

To obtain reasonable aesthetic results, liaising with the orthodontist is important when considering full closure of the gap where the maxillary lateral incisors are missing. Interproximal reduction of the canine can be considered before planning the width of space closure to help to achieve the desired width of a lateral incisor. If present, the contralateral lateral incisor can be used as a reference, or by following other biomimetic guides.

When, and if appropriate, one can consider minor enamel reduction of the labial aspects of the canines to resemble a lateral incisor. Could a more acceptable result be achieved by removing a small amount of enamel from the convex labial surface of the canine before subtly adding composite resin to the rest of the labial surface? A clinical tip is to 'mock-up' some possible ideas on the unetched enamel to assess the visual effects before committing to doing any labial enamel reduction of the canine. Extensive destruction for a ceramic veneer or for multiple ceramic veneers is not, in these authors' views, something to be undertaken lightly, because it can result in irreversible destruction of a significant amount of tooth tissue at an early age.[9]

When modifying the canine to resemble a lateral incisor, the shape, size, colour and periodontium of the tooth all need to be considered carefully. Following orthodontic treatment and selective nightguard bleaching, then using a combination of enamel reduction and composite addition, the visual appearance can be improved modestly at a low biological cost.[7]

Figures 9 and 10 demonstrate a case where space closure and canine modification using composite bonding were used to manage missing maxillary lateral incisors.

Choosing a composite colour to eliminate the dark triangles around a pointed maxillary canine tip

Bonding and sculpting opaque composite (usually opaque A2) on to the palatal aspects of the canines can quickly change the pointy appearance. Once cured, a lighter coloured composite can be cured in position at 45 degrees to the labial surface to eliminate the dark triangles without making the teeth look far too wide.

Composite can be added to the mesial and distal corners and the incisal tips of the upper teeth in order to appear to better follow the outline of the lower lip, and doing this will often help to achieve a reasonable aesthetic result. This process can make all six of the incisal tips appear to be parallel to the interpupillary line.[8]

In some cases, mild canine tip reduction may also be undertaken.[7] The amount to be removed from the canine tip can be simulated by drawing on the tip of the canine with a fine black permanent ink pen (eg Stabilo Permanent Black Ink, Staedtler) and shown first to the patient and parent. If they give their consent, then one just has to gently reduce the area where the black ink pen is present.

Infilling the occlusal aspect of the maxillary premolars can help to resemble the canine tooth. This should only be carried out if that is deemed to be desirable for that patient and functionally acceptable.

For cases with high smile lines, a disadvantage of using the canine as a lateral incisor is the more apical position of the gingival margin (Figure 10). The discrepancy in gingival margin level is much less obvious in low smile line cases and, therefore, can often be more readily acceptable to patients and parents (Figure 7).

Microdont teeth

Microdont teeth are developmentally smaller than average tooth sizes.[10] It is common for patients to present with a diminutive contralateral lateral incisor in hypodontia cases. The use of direct composite is a minimally destructive method of producing a better appearance for the microdont tooth, as opposed to the more aggressive crown option.

It is important to correctly identify the shade of the microdont and adjacent teeth early on. The method of shade matching on unetched enamel will improve colour matching, especially if a layering technique is to be used.

Rubber dam is considered the gold standard by most in achieving moisture control. If rubber dam is to be used, multiple tooth isolation with floss ligatures and accurate shade matching with hydrated teeth prior to isolation is advised. However, moisture control can be attainable using cotton wool rolls, gauze and cheek retractors such as OptraGate (Ivoclar Vivadent, Schaan, Liechtenstein).

Those pragmatic methods permit complete visualization of the adjacent and contralateral teeth in order to help to achieve reasonably satisfactory aesthetic results. The use of a tooth separation medium ensures adequate isolation of neighbouring teeth, preventing undesirable etching and bonding of adjacent teeth, and avoids having to separate them afterwards.[11] PTFE tape, plastic or metal matrices, such as small sections of Komet stainless steel metal serration strips (Komet Dental, Germany) can all be used.[11] A very light bevel or roughening of the surface can aid in disguising margins at the enamel-composite interface.

One approach to create the form of a tooth is to use a silicone putty matrix. In order to facilitate this, a diagnostic wax-up should first be prescribed. For hypodontia cases, this will commonly feature a waxed-up canine to resemble a lateral incisor. Once satisfactory, an impression capturing the palatal aspect of the wax-up is created using silicone putty. This matrix allows the first layer of clear

composite to create the palatal anatomy of the proposed tooth in the patient's mouth. Composite can then be layered on top of that to create the general shape and the labial anatomy.

During the composite bonding stage, the three-step etch, prime and bond system is the accepted gold standard.[12,13] Long-term clinical trials have proven the efficacy of this system in comparison to a one-bottle system (conditioner/primer/bond). It is advisable to follow the manufacturer's instructions when using these materials to achieve predictable outcomes.[12]

Composite resin 'sticking' on to instruments is a commonly encountered difficulty. Instruments with a 'non-stick surface', such as those coated with titanium nitride, have been shown to reduce the effects of this undesirable feature.[13]

Another useful clinical tip when using composite is to chill the composite first. Cooling it stops it from 'slumping' during the sculpting. Conversely, in some layering techniques, warming the composite in dedicated composite tube warmers is advocated to improve the flow and enables it to wet the underlying layer as the tooth is built up in layers. The use of unfilled resin, as a layer on the composite surface following polishing and to handle uncured composite is best avoided, as it reduces surface hardness.[13]

When light curing composite, oxygen from the air interferes with the polymerization of the surface layer, creating an oxygen-inhibited layer. The topical application of glycerin over the cured composite, which can be economically sourced from pharmacies or supermarkets as medical grade lubricating jelly (KY Jelly), creates a barrier. Doing that allows complete composite polymerization, without air inhibition thereby producing optimal surface hardness.[14]

During the polishing stage of the procedure, another clinical tip is to polish in the direction that the bur is spinning and to run the bur from the composite on to the enamel. Following the direction of the bur spin will create a smoother transition and prevent gouging of the composite. Conversely, polishing by running the bur in the opposite direction will create a visible white line, which will stain over time. It is advisable to inform the patient that over time refinement and polishing of the composite is likely to be required, but that their sound underlying tooth tissue will remain protected.

In some cases the composite bonding can be carried out without local anaesthetic. This is an important discussion to have with the patient. All excess composite in or around the gingival margin must be removed to allow effective cleaning and thereby prevent creating long-term periodontal problems. The routine use of local anaesthetic and warm local anaesthetic will make this procedure much more comfortable for patients.

Discussion

Prior to the commencement of treatment, liaising with an orthodontic department will help to ensure appropriate, timely care is provided and, hopefully, lead to better patient outcomes.

Treatment usually extends over a number of years in primary and secondary care. During ongoing treatment, one should consider the patient's wishes carefully and provide appropriate, neutral, visual, verbal and written information to help them in their decision-making processes.

Given the wide range of treatment options available, then for their consent to be considered to be valid, the patient must really have understood the Montgomery 'material risks' and the realistic *limitations* of any proposed plan – and not just the benefits of each viable treatment option, including no treatment.[15]

Following treatment in secondary care, patients need to be able to develop a functional working relationship with a GDP for ongoing maintenance. Composite restorations will deteriorate gradually over time but can be polished or refreshed at recall visits to maintain aesthetics. A fairer reward system within the promised new NHS contract might have allowed for a fairer fee for indirect restorations, but those pilot schemes are now history. Although some GDPs might not wish to engage with addressing some of the more complex issues, they have an important role in recognizing problems and instigating referrals for further management as appropriate.

Conclusion

A wide number of restorative challenges present in hypodontia cases. Some of the clinical tips that have been described might be helpful in achieving acceptable aesthetic and functional outcomes and facilitate long-term maintenance.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual participants included in the article.

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