Restorative Management of the Cleft Patient: CLP Series Part 10

Abstract: This article describes the role of the restorative dentist in the multidisciplinary management of cleft lip and palate patients. The various clinical presentations and restorative challenges are outlined. The restorative treatment of cleft patients requires the use of a wide range of different clinical skills and techniques to achieve oral rehabilitation. The various treatment modalities are described and range from minimally invasive adhesive techniques to conventional fixed and removable prosthodontics, obturators and the use of dental implants. The eventual restorative outcomes are related to the initial severity of the defect and the degree of success of the previous surgical and orthodontic interventions.

Clinical Relevance: This article will be of interest to clinicians, technicians, dental care professionals and other members of the team who are involved in the oral rehabilitation of cleft patients.

Cleft lip and palate (CLP) is the most common congenital craniofacial anomaly. It has an overall incidence of 1 in 700 live births¹ and has a multi-factorial aetiology. A multidisciplinary team (MDT) is involved in the management of a cleft patient, and can include an orthodontist, ear, nose and throat specialist, maxillofacial/plastic surgeon, speech therapist, clinical psychologist, paediatric dentist and a restorative dentist. This article will discuss the role of the restorative dental specialist in the management of this challenging group of patients. The restorative management of these patients during the deciduous and mixed dentition phases will not be discussed in this article.

Cleft patients comprise a heterogeneous group of patients, which have been treated in a variety of different ways over the decades, often with less than satisfactory results.² The treatment of cleft lip and palate patients has improved dramatically over recent years, with modern multidisciplinary management giving the best chance of a good outcome for these patients. Patients with CLP may present with a number of diverse and challenging problems related to:

- The cleft defect itself;
- Missing teeth in the cleft region;³
- Hypomineralized teeth around the cleft;
- Rotated or microdont teeth;
- Arch-width discrepancies between the maxilla and mandible; and
- A reduced vertical face height.⁴

Cleft patients may have higher levels of cariogenic bacteria⁵ and may be at an increased caries risk compared to non-cleft patients,⁶ although the evidence for this is not strong.⁴ Nevertheless, preventive measures, such as dietary advice, oral hygiene instructions and the use of fluorides should be instigated at an early age⁶ to ensure that the patient can maintain a dentition that is free of dental and periodontal disease. This is crucial to the long-term success of any form of adult restorative dentistry.

The restorative dentist has an important role to play in this multidisciplinary management with regard to contributing to the treatment planning process. Issues related to the optimal distribution of spacing within and between arches, the prognosis of compromised teeth and the prospects for aesthetic enhancement of malformed or malpositioned teeth are best considered with the help of a restorative specialist. In addition, the best means of replacing any missing teeth, together with their associated soft tissues and alveolar bone can only really be planned and executed by the restorative dentist. It is very important that these issues are decided upon before the start of any significant orthodontic treatment in order to ensure the best outcomes for cleft patients.

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The restorative management of the adult cleft patient can be broadly divided into two different categories:
- Patients without a palatal defect; and
- Patients with a palatal defect (either unrepaired or residual defect after an attempted surgical repair).

**Patients without a palatal defect**

**The dentate and partially dentate patient**

Patients without significant arch-width/vertical discrepancies

Younger patients in this group will have received a multidisciplinary treatment approach. This may have included early surgery to repair the lip and palatal defect, an alveolar bone graft (ABG) in the cleft region, orthodontic treatment to expand the maxillary arch/redistribute any spacing between the teeth and perhaps orthognathic surgery to correct any underlying skeletal discrepancy, as well as corrective nasal surgery. In this group, there may be minimal discrepancy between the mandible and maxilla in terms of arch-width ratio and vertical relationships, with these patients representing the optimal outcome of contemporary multidisciplinary treatment.

Restorative treatment in this group may simply involve the use of composite bonding techniques to mask areas of hypo-plastic or hypo-mineralized enamel or to disguise small tooth size and poor shape or camouflage any positional discrepancies. Tooth whitening may also be used to good effect in some young patients where there has been a detrimental shift in tooth shade. In some of these patients there may be a small number of missing teeth, but space has been closed by orthodontic treatment, avoiding the need for a dental prosthesis. More commonly, however, space is maintained or opened as part of maxillary arch expansion and a prosthesis is required.

A common example of space closure is where there is a missing lateral incisor and the canine is repositioned with orthodontic treatment so that it is adjacent to the central incisor. The canine teeth need careful assessment with regard to their size, shape, bulbosity, colour and gingival level to ensure that they can be disguised as lateral incisors. Reducing the incisal tip and adding composite resin to a canine tooth can be very effective in simulating a lateral incisor tooth (Figure 1). Minor reduction of the buccal bulbosity and tooth whitening can also be useful adjuncts in some cases. Orthodontics can help in positioning a canine to optimize the gingival level and reduce the buccal prominence of the tooth. The authors favour using direct composite bonding to reshape teeth in general, rather than porcelain veneers or crowns. The technique is relatively quick, non-invasive and allows the clinician to have significant control over the aesthetics of the definitive composite restoration.15 In the young patient, porcelain veneers are ill advised as gingival maturation in the late teens and early twenties can lead to the veneer margins/cement lute becoming visible and leading to replacement restorations and further destructive tooth preparation.

In other situations, orthodontic repositioning of the teeth may be needed to open space for a prosthetic tooth, eg for a missing maxillary lateral incisor (Figure 1). The space needed to accommodate an aesthetic prosthetic tooth needs to be carefully planned and it is not only the width, but also the shape of the space, which needs consideration to achieve optimum aesthetics. The importance of achieving symmetry in the aesthetic zone cannot be overemphasized. The position and angulations of adjacent tooth roots may need to be corrected if dental implants are to be considered. Bone and soft tissue factors also need to be assessed, as this will affect the decision as to whether a bridge, implant or denture will result in the best outcome.

Patients with a minimal number of missing units and relatively narrow pontic spaces may be best rehabilitated with resin-bonded bridgework (RBB). The principles of adhesive bridgework in this group are no different from those employed whilst treating a non-cleft patient. The abutment teeth should be of reasonable size and minimally restored in order to provide the maximum surface area of enamel for adhesive bonding. It may be helpful to carry out a crown lengthening procedure on potential abutment teeth, with either electrosurgery or conventional periodontal flap surgery to gain a greater surface area for bonding. A sand-blasted, non-precious metal wing retainer should be prescribed for the abutment teeth and the casting itself should cover as much enamel as possible,11 commensurate with aesthetics. To maintain bond strength integrity, any preparation of the abutment teeth should be minimal and remain within enamel. It has been reported12 that the median survival rate of a cantilevered RBB is 9.8 years, whilst the corresponding survival rate for a fixed-fixed design is 7.8 years. In this study, the authors were able to achieve these high success rates without heavily preparing the abutment teeth. RBBs therefore represent a predictable and non-invasive means of replacing teeth. They can be used in patients who are unwilling to have implant surgery, or are unsuitable owing to continuing growth, poor bone stock or adverse positioning or curvature of the adjacent roots into the edentulous space.

A fixed-fixed RBB design will certainly help to maintain post-orthodontic tooth stability. However, teeth can move within the periodontal ligament and differential tooth movements between the two abutment teeth can result in one of the wings debonding, plaque accumulation and the development of dental caries. Given this inherent risk, the authors prescribe cantilevered bridge designs (with single unit pontics) wherever possible and employ long term use of removable orthodontic retainers, although obviously there are patient compliance issues to consider.

The bone stock in the cleft area is often rather poor in quality, but...
dental implants can be utilized in some cases, particularly away from the cleft region itself (Figure 2). Several studies have reported high implant success rates in cleft patients ranging from 90% to 99%, with mean follow-up times varying from 3 to 9 years.13–16 As with non-cleft patients, implant rehabilitation should be considered once growth has stopped.17 Where the bone is inadequate, in volume or quality, to accommodate a dental implant a variety of augmentation techniques are possible. For larger bone defects, it may be necessary to augment the site with autogenous bone blocks from the chin,18 ramus or iliac crest.13,16 After a suitable period of bony healing, dental implants may be placed in the grafted bone. For smaller hard-tissue defects, guided bone regeneration employing a combination of autogenous bone chips (from intra-oral donor sites), a xenograft (such as bovine bone granules) and a collagen membrane can also be used19 with simultaneous implant placement. The edentulous site itself may be narrow mesio-distally and it may be necessary to place smaller diameter implants at the time of surgery. The soft tissue morphology around the cleft may also be unfavourable and may be improved by the use of a free connective tissue graft harvested from the palate.20

**Patients with significant arch-width/vertical discrepancies**

In some cleft patients, particularly those in the older age groups, surgical and orthodontic treatment may have closed the palatal defect and aligned the arches but failed to correct the underlying skeletal and dental mal-relationship. This often results in a significant arch-width discrepancy, with or without a reduced vertical dimension. In such cases, the restorative dentist may be restricted to the provision of an onlay (OnD) or overlay (OvD) denture (Figure 3). Onlay/overlay dentures are non-invasive and can be used to replace teeth/soft tissues effectively, disguise any arch/width discrepancy, restore the vertical dimension and improve facial form. However, the inclination and distribution of undercut areas around the maxillary teeth may require the prescription of a complex metal framework, which can be challenging to fabricate and requires excellent technical support. Several authors have reported the use of gold thimble crowns/telescopic insertions within the denture base, as well as precision attachments to aid retention and stability of the appliance.21,22

**The edentulous patient**

These patients are of course usually elderly and have had surgical treatment to close the palatal defect, which often failed to correct the underlying skeletal and dental mal-relationship. The residual scar tissue often leaves an irregular palatal anatomy, shallow palatal vault and an inelastic and unyielding upper lip. This makes it difficult to obtain a peripheral seal for a complete denture23,24 and consequently leads to poor retention and stability. There is often a Class III skeletal relationship that makes it even more challenging to construct a stable prosthesis. If there are remaining mandibular teeth, these can further contribute to instability of the maxillary complete denture. In some older patients the palatal cleft defect was closed with various types of soft tissue flaps, which resulted in a poor quality,

![Figure 2](image1.jpg)

**Figure 2.** (a) Anterior view of repaired bilateral cleft patient with the upper central incisor roots serving as overdenture abutments and a missing UL2; (b) occlusal view pre-treatment. (c) Provision of two implant-supported crowns, UR1, UL1, and resin-bonded bridge to replace the UL2 (using the UL4 as the abutment tooth) and acceptance of the anterior crossbite relationship. Composite bonding to mask UR3, UR4 and UL4; (d) occlusal view following treatment.

![Figure 3](image2.jpg)

**Figure 3.** (a) Repaired bilateral cleft patient with a significant arch-width and vertical discrepancy between the upper and lower jaws. (b) Occlusal view of collapsed maxillary arch. (c) Provision of a removable, overlay partial denture. (d) Complex metal framework required to overlay the maxillary teeth.
highly displaceable denture-bearing area. Despite the anatomical challenges, the principles for constructing conventional dentures are the same as those for a non-cleft patient.

For cleft patients who are unable to tolerate conventional complete dentures, it may be necessary to help retain and stabilize the prosthesis with dental implants. However, there will be cases where there is inadequate bone in the posterior maxilla to allow for implant placement. For these patients, it may be necessary to consider bone grafting procedures to facilitate the placement of root form endosseous implants, with some authors advocating the use of zygomatic implants.

Patients with a palatal defect

The dentate and partially dentate patient

Patients in this group usually present with a palatal defect, despite previous attempts at a surgical repair, although there are still a few older patients that have been left with an unrepaird palatal defect. The oro-nasal communication may contribute to a hyper-nasal speech pattern and difficulties with feeding and drinking. Where there is only a small fistula, some patients are surprisingly able to manage without any intervention, although most patients need the provision of a removable obturator appliance to seal the palatal defect effectively and facilitate feeding without nasal leakage.

If they have a small number of missing teeth and a favourable ridge form, they can be managed with either small span conventional or resin-bonded bridgework (RBBs) or implant-supported crowns/bridges to restore the integrity of the arch and then have a simple, removable obturator plate constructed (Figure 4). This has the psychological advantage that, when the patient removes the obturator plate for cleaning and at night, he/she still has an intact arch of teeth, with no deficit in appearance.

Patients with more extensive palatal defects, larger alveolar defects and larger edentulous saddles may be best provided with an obturating removable partial denture (ORPD). These cover considerably more soft and hard tissue than a fixed prosthesis and so pre-dispose the patient to increased plaque accumulation. Therefore, a good standard of plaque control is desirable to prevent periodontal and dental disease. If the remaining dentition is suitable, the authors favour a metal-based prosthesis with good tooth support and retention from appropriately placed claspung units (Figure 5). A metal framework is preferable to acrylic as the former will be considerably less bulky and more hygienic. If an anterior flange is provided, it must be correctly extended to prevent soft tissue trauma and denture instability, whilst providing optimal lip support. This can be difficult owing to scarring of the lip following surgical repair.

The framework will need to accommodate an obturator component, which can be of various designs, depending upon the morphology of the palatal defect, operator and patient preference. Simple plates can be used of acrylic or metal but, where there is an extensive palatal defect, it may be that a more complex obturator design is needed to engage the defect more positively (see below).

Patients with multiple or...
large edentulous saddles may find it difficult to control an ORPD. The weight of the prosthesis, inadequate numbers of abutment teeth for claspings and compromised denture support area are technically challenging. In such cases, the use of milled crowns and precision attachments may be considered to improve the prognosis. An implant-retained partial denture may, however, offer a more effective way to improve the retention and stability in these cases.25

The edentulous patient

Edentulous cleft patients can be rehabilitated with complete dentures that include an obturating bung (Figure 6). Various designs may be employed, depending on:
- The size/nature of the defect;
- The patient’s previous obturator wearing experience;
- Operator skill; and
- Laboratory support.

Retention can be difficult owing to the sheer weight of the prosthesis, although this can be reduced significantly through the use of a hollow box design (with or without lid). A resilient, silicone soft lining material may be incorporated on to the surface of an acrylic obturator. Generally, this is only used if hard acrylic cannot be tolerated, as the silicone will need regular replacement due to deterioration in the mouth over time. The size and location of the palatal defect may result in minimal support being present for a complete denture. Furthermore, the non-resilient nature of the peripheral tissues can make it difficult to achieve an adequate peripheral seal.26

In some cases, dental implants can be extremely useful in providing some extra retention and support for a prosthesis (Figure 7), although an adequate volume and quality of bone is required to accommodate endosseous implants. Some patients will require bone grafting procedures prior to (or at the time of) implant placement. A properly constructed implant-retained prosthesis will be considerably more retentive than a conventional obturator and significantly enhance the patient’s speech, masticatory function and quality of life.24

Discussion

Although modern multidisciplinary management offers a higher likelihood of optimal outcome for the younger cleft patients, results can still be far from ideal, depending upon the severity of the initial defect, success of the various surgical and orthodontic treatments, the quality of the restorative interventions and, of course, the compliance and motivation of the patient. In some cases, patients become dentally demotivated, probably due to the multiple interventions that they have had to endure during their lifetime.

The restorative dentist has a very important role to play in this multidisciplinary management with regard to treatment planning and should be involved early in the decision-making process. Issues, such as the optimal distribution of spacing within and between arches, the prognosis of compromised teeth and the prospects for aesthetic enhancement of malformed teeth, need to be considered. The best means of replacing any missing teeth as well as soft and hard tissues should be decided upon by the restorative dentist. These issues are very important in ensuring good outcomes and should be decided upon before significant orthodontic treatment is started. The restorative treatment of cleft patients requires the use of a wide range of different clinical skills and techniques to manage the diverse and challenging nature of the patients and their oral condition successfully.

In the younger patient group, the use of minimally invasive, adhesive restorative techniques has the greatest application. The use of composite bonding, tooth whitening, porcelain veneers and adhesive bridgework should mean that fewer healthy teeth will have to undergo the invasive tooth preparations associated with conventional crown and bridge procedures. This should reduce trauma to the dental pulp and hence reduce the potential for endodontic problems and possible tooth loss in the future.

There is still a significant group of older patients that remain with relatively diverse, complex and challenging restorative treatment needs27 that will require ongoing specialist care for many years to come. These patients often require the use of conventional fixed bridges, complex removable partial and complete dentures, as well as obturator appliances to rehabilitate them fully. Minimally invasive techniques may, however, still be useful in some older patient and should be used wherever possible.

Osseo-integrated dental implants can now be successfully utilized in cleft patients to replace single and multiple missing teeth with fixed crown and bridge work and hence avoid the need for removable prostheses in many instances. Even when this is not possible, owing to adverse bone and soft tissue factors, implants can sometimes be used to improve the retention and stability of removable partial or complete dentures and obturator appliances. In some cases, dental implants may be the only means of achieving a successful removable prosthesis.

The oral rehabilitation of a patient with CLP may require compromise in terms
of treatment goals. There may be cases where the hard/soft tissue profiles may be unfavourable and the patient may not be suitable for (or is unwilling to have) further surgical intervention. There may be less than ideal occlusal relationships or insufficient space to accommodate aesthetic prosthetic teeth. In such cases, it is paramount that both the clinician and patient are aware that the outcomes of any treatment will have limitations. This requires a thorough appreciation of restorative dentistry and the ability of the clinician to communicate these limitations to the patient and other members of the cleft MDT. The entire process requires excellent communication, collaboration and teamwork involving not only the dental team but most importantly the patient as well.

References