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Restorative Options for Hypodontia in the Anterior Sextant of Adolescent Patients

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Abstract

Hypodontia is a developmental dental anomaly of primary and permanent dentition, defined as the developmental absence of one to six teeth. Adolescent patients with hypodontia in the anterior sextant present unique restorative challenges due to esthetic needs, incomplete skeletal growth, relatively large pulp chambers and unrestored proximal teeth. Patient-specific factors need to be carefully evaluated for successful treatment planning and restoration. This paper discusses various treatment options for hypodontia in the anterior sextant, as presented in the literature, including the indications, contraindications, advantages, and disadvantages of each. This review will help pediatric-restorative dentists in selecting the appropriate treatment modality for managing hypodontia in adolescent patients.

Keywords: Hypodontia; Incomplete skeletal growth; Adolescent patients

Abbreviations: ISR: Implant Supported Restorations; RBB: Resin Bonded Bridges; CB: Carolina Bridge; MB: Maryland Bridge; RPD: Removable Partial Dentures; FPD: Fixed Partial Dentures; CS: Canine Substitution.

Introduction

Hypodontia is the most prevalent type of developmental tooth anomaly [1]. It is categorized as a number anomaly due to defects seen during the initiation phase of tooth development. It is further defined as the failure of development of one to six teeth [1]. Congenital absence of more than six teeth is termed oligodontia while, anodontia is the complete absence of teeth and is considered a severe version of hypodontia [2]. The prevalence of hypodontia varies among different populations, but has been reported between 1.6-36.5% [1]. Hypodontia in the anterior sextant most commonly affects the permanent maxillary lateral incisors, [3,4] with a prevalence of 2.2% [4]. Absence of teeth can be a significant challenge for both patients and pediatric-restorative dentists. Consequences of hypodontia include functional and esthetic limitations and can also have a significant psychosocial impact; especially on adolescent patients [5,6]. During adolescence, patients become increasingly aware of their self-image and esthetic social constructs [3]. Tipping of the teeth into the edentulous space and super-eruption of opposing teeth can make future treatment challenging due to increased loading, wear, periodontal implications, and other general dysfunctions [7]. Many patient-specific factors need to be evaluated before planning restorative treatment for hypodontia in an adolescent patient. Various treatment options for the management of hypodontia in the anterior sextant are implant-supported restorations, resin-bonded bridges, the Carolina bridge, the Maryland bridge, removable partial dentures, fixed partial dentures, and canine substitution. Based on the reviewed literature, the indications, contraindications, advantages, and disadvantages of each treatment modality is provided in Table 1 for pediatric-restorative dentists.

Modality	Indications	Contraindications	Advantages	Disadvantages
Implant-supported restorations	-Replacement of single missing teeth	-Incomplete skeletal growth -Poor periodontal support -Complex systemic history or comorbidities	-Superior esthetics -Predictable and functional outcomes -Conservative to the adjacent dentition	-More chairside time -Expensive -Requires adequate periodontal support -Can only be planned after completion of growth
Resin-bonded bridges (Carolina Bridge or Maryland bridge)	-Replacement of single missing teeth -Used as a transitional prosthesis	-Heavy occlusal contacts -Parafunctional habits -Enamel defects	-Good esthetics -Conservative -Better periodontal health and hygiene -Reduced risk of pulp de-vitalization during preparation	-Differential loading can lead to debonding -Aspiration risk or secondary caries due to debonding -*Graying out* can compromise esthetics of Maryland bridge
Removable partial denture	-Replacement of multiple missing teeth and/or soft tissue -Used as a transitional prosthesis	-Poor oral hygiene -Poor patient compliance	-Conservative -Replacement of multiple teeth and/or soft tissue	-Need for relining or refabrication in growing patients -Higher chances of misplacing or damaging the prosthesis -Plaque retentive
Fixed partial denture	-Abutments with or future need for restoration -Enamel defects in abutment	-Anticipated pulp exposure during preparation -Healthy abutments	-Superior esthetics -Require no bone or soft tissue support	-Risk of pulp de-vitalization -Irreversible procedure -Periodontal complications
Canine substitution	-Angle I with indicated extractions -Angle II with no crowding	-Inappropriate occlusal scheme -Significant color or morphology differences between canine and central incisor	-Use of patient's natural dentition -Great biological and periodontal outcomes -Early treatment	-Need for orthodontic treatment -Esthetic modifications may lead to sensitivity -Group function occlusion

Table 1: Treatment options for Hypodontia in Adolescents.

Implant-Supported Restorations

For healthy patients with hypodontia, non-restored adjacent teeth and completed skeletal growth, implant-supported restorations (ISR) are the ideal method of choice [8,9]. They are conservative, esthetic and functional, allowing for preservation of the integrity of adjacent teeth [8]. Additionally, ISR are a predictable definitive treatment option [6,10-12]. The survival rates of ISR for single missing teeth over a 5-year and 10-year period are 94.5% and 89.4%, respectively [13]. However, because ISR require adequate periodontal support, the placement takes a significant amount of chairside time and expense. Additionally, ISR are contraindicated in patients with incomplete skeletal growth [14-17]. If placed prematurely, ISR tend to behave similarly to ankylosed teeth [14,18] with infra-occlusion and labial positioning as potential consequences [19]. Additionally, young patients tend to have more brittle cortical bone and a more aggressive immune system, which can propagate failure of the ISR [20]. Therefore, placement of ISR should be deferred until the appropriate age and growth status of the patient has been reached, which is around 18-20 years for females and 20-22 years for males [17].

Resin-Bonded Bridges

Resin-bonded bridges (RBB) are another treatment option for hypodontia. Meta-analyses reporting survival

rates of RBB showed 87.7-92.3% survival over 5-year period, [21] with the most common complication being debonding and subsequent risk of secondary caries or aspiration [22,23]. Another meta-analysis reported 91.7% and 82.9% success rates of RBB at 5-and10-years, respectively [24]. Regardless of the design of the RBB, in order to maintain optimal retention, it is important that the pontic have no-minimal occlusal stress while in centric and no contact during excursive movements [25,26].

The Carolina Bridge (CB) is an all-ceramic feldspathic pontic RBB. The CB is bonded to abutment teeth on their proximal surfaces, thus requiring no-minimal abutment preparation and hence is considered both a conservative and reversible treatment option [27]. Additional benefits of RBB or the CB are decreased chances of pulpal exposure during abutment preparation in immature teeth and favorable periodontal conditions due to supragingival margins [28,29]. However, the use of RBB or the CB requires a carefully selected occlusal scheme, favorable periodontal health of abutment teeth and adequate interproximal surface area and substrate for bonding [30]. Additionally, patients with enamel defects in abutment teeth and parafunctional habits are not appropriate candidates for the CB or RBB in general [27]. Assuming the above criteria are met, a CB is ideal as a transitional (long-term interim) prosthesis that can replace a single missing incisor, while awaiting the completion of skeletal growth for an ISR.

Cantilever-designed RBB (C-RBB) are bonded only on one proximal side of the pontic to a single abutment tooth, and have shown superior retentive results when compared to two-abutment, fixed-fixed RBB [24,25]. This is due to less stress being placed on the connectors during function, since issues of differential tooth movement can be avoided with the use of a single abutment [15,28,29]. In the case of a C-RBB, debonding leads to an immediate failure with the prosthesis falling out [15,29]. Although this leaves an unesthetic edentulous space for the patient, the risk of secondary caries is reduced with this immediate failure [15,29]. Additionally, the C-RBB is easier to floss and maintain hygiene around, so a decreased incidence of periodontal consequences are reported [26,29].

The Maryland Bridge (MB) is another variant of RBB. Typically, the MB possesses a metal retainer, which although increases strength, has been shown to compromise esthetics, described as “graying out” of the abutment teeth [15,25,27,29]. Although still a conservative option, the MB requires greater tooth reduction and preparation as compared to the CB. In order to utilize a MB in patients during adolescence, when abutment teeth have relatively larger pulp chambers, adequate overjet and overbite are critical to maintain a conservative and retentive preparation.

Removable Partial Dentures

Removable partial dentures (RPD) are also a conservative option, requiring no-minimal preparation of the abutment teeth [10,27]. They are advantageous due to their ability to replace multiple missing teeth and soft tissue deformities, whilst preserving adjacent dentition and maintaining the option of a more definitive restoration at a later date [15,25,30,31]. However, patient acceptability and increased plaque retention make them less appropriate for adolescent patients [10,15,25,27,32]. Removable prosthesis innately bear a higher risk of damage and/or loss than fixed restorations, especially in adolescent patients. Additionally, continued jaw growth throughout adolescence can lead to a poor fitting prothesis, requiring frequent relining or refabricating and an overall complication of treatment [9].

Fixed Partial Dentures

Conventional fixed partial dentures (FPD) allow for esthetic restoration of multiple missing teeth. However, FPD may not be a suitable option in adolescent patients due to the aggressive nature of tooth preparation that is required [6,8,15]. This renders the treatment irreversible, permanently compromising abutment teeth [8,27]. Studies have shown as much as 25-50% less tooth structure removal with RBB when compared to FPD [33]. Often in the adolescent patient, the adjacent dentition is healthy, so significant reduction to accommodate FDP design is unmerited. Additionally, the placement of margins can impede hygiene or otherwise lead to periodontal implications surrounding the FPD. It is important to remember that adolescent teeth possess relatively larger pulp chambers, so preparation for FPD fabrication carries an increased risk of pulp de-vitalization [6,8,11,15,17,25]. It is worth noting that, 32.6% of abutment teeth used for FPD have been shown to lose vitality in a 5-year period [34]. Additionally, failure of a single component of FPD leads to a detrimental failure of the complete FPD [8,11,15]. A study of the longevity of FPD estimated 8.3-10.3 years, indicating that several replacements would be necessary for younger patients throughout their lifetime [34-36].

Canine Substitution

Canine Substitution (CS) is categorized as orthodontic management of hypodontia in the anterior sextant, rather than a restorative option. In cases with favorable occlusal relationships, such as Angle Class II with no crowding or Angle Class I with planned extractions, CS is a reasonable treatment option [14,17,37-39] CS involves orthodontic movement of the patient’s canines to replace the missing lateral incisors. The outcome is esthetic and preserves biologic health and functionality [3,17,18,39,40] Moreover, treatment can be done quickly and with intervention at an early age [41].

Unfortunately, differences in color and morphology between the canine and lateral incisor can make this treatment fairly invasive, requiring significant recontouring and bleaching of the existing canines, which can lead to increased sensitivity [5,14,17,37,40-42]. Comprehensive orthodontic and periodontal treatment is necessary to align appropriate gingival zeniths, and re-distribute the canine eminence to establish favorable esthetics, this adds both time and complexity to the treatment [5,17,18,40-42]. A significant factor associated with CS is the change in occlusion and function of the patient to group function, rather than canine-protected occlusion [38]. However, functional success for CS has been reported at 10 years [5] and literature has reported no differences in signs and symptoms of temporomandibular joint disorder compared to patients treated with other modalities [3,18,41]. A study comparing the esthetic outcome of ISR and CS reported that dental professionals ranked the ISR and CS as equally esthetic, while laypersons preferred CS [43]. The study concluded that patients may have different esthetic preferences than the provider and therefore, thorough discussion is warranted during treatment planning.

Discussion and Conclusion

Adolescent patients present with unique challenges when compared to adult patients, which must be carefully considered when treatment planning. During the treatment planning phase, it is essential that the pediatric-restorative dentist consider patient factors and desires, as well as the future definitive treatment plan. The presented reversible treatment options can be great tools, allowing for later placement of definitive restorations after the completion of growth. Peediatric-restorative dentists can pursue various treatment options for the management of hypodontia in the anterior sextant of adolescent patients. Each modality provides its own advantages, disadvantages, and indications which must be carefully considered during treatment planning. Patient selection involving occlusal factors, growth status, esthetic concerns-needs, and the condition of the remaining dentition are key and essential aspects in the successful treatment of hypodontia. This literature review can or will serve as an important resource for pediatric-restorative dentists when treatment planning.

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