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Research Paper

Full Mouth Rehabilitation of a Pediatric Patient and Use of a Modified Groper Appliance

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ABSTRACT
Background: *Early childhood caries (ECC) is a rapidly progressing condition that can severely affect the dentition of young children, often requiring extensive treatment. Full mouth rehabilitation in such cases poses clinical and behavioral challenges, especially in very young patients.*
Case Description: *This case report describes the comprehensive dental management of a 3-year-old pediatric patient with severe ECC. Clinical and radiographic examination revealed extensive decay in both anterior and posterior teeth, with multiple non-restorable teeth. Various behaviour management techniques were employed. Posterior teeth were restored using stainless steel crowns, while severely decayed anterior teeth were extracted. To restore esthetics and maintain function, a modified Groper appliance was fabricated and cemented. The appliance was customized leading to better masticatory efficiency, supporting speech development and psychological well-being. Timely recall visits were scheduled for 1 year. Parental satisfaction was high, and oral hygiene was maintained adequately.*
Conclusion: *This case emphasizes the importance of early intervention and the role of modified prosthetic appliances in restoring function and esthetics in very young pediatric patients undergoing full mouth rehabilitation.*

KEY WORDS: ***Early childhood caries, mouth*** *rehabilitation, dental prosthesis.*

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I. INTRODUCTION

The role of primary dentition is crucial for establishment of occlusion, mastication, phonation and esthetics. The premature loss of primary teeth hence poses to be an impediment for the same affecting the development of the child functionally, morphologically and psychosocially [1]. Early childhood caries (ECC) is one of the most common etiologies for premature loss of deciduous teeth. The other causes being extensive traumatic injuries to teeth, neonatal tooth extraction and premature root resorption [2], [3], [4].

ECC not only affects the child but the parent or caregiver as well. Parental desire longing for improved esthetics for the child becomes one of the decisive factors for placing an esthetic appliance. Esthetic and functional rehabilitation of a young toddler with early loss of multiple deciduous teeth is one of the challenging tasks for a pediatric dentist from the restorative point of view [5]. Successful full mouth rehabilitation of such a patient is the culmination of multiple visits, parental counselling, skilled clinical expertise, application of various behaviour management strategies during the operative procedure and precise laboratory works. In this perspective, various aesthetic options render solutions, such as removable or fixed partial dentures. Considering the age, compliance and safety of the patient fixed partial denture becomes the choice of the esthetic appliance. The prosthetic appliance should be such that it should not hinder the progression of eruption of the underlying successor teeth [6].

The intent of this case report is to depict the full mouth rehabilitation of a toddler suffering from severe

early childhood caries where multiple teeth underwent endodontic treatment followed by full coverage restorations and a fixed, esthetic, long span modified Groper appliance was successfully delivered to restore the function as well as meet the esthetic concerns for the child.

II. CASE DESCRIPTION

A 3-years-old female child reported to the Department of Pedodontics and Preventive Dentistry with the chief complaint of pain in the upper right and left back teeth region since few days and presence of multiple decayed teeth. Patient's guardian was concerned about the child's unesthetic smile (Figure 1A) and her inability to chew food properly. The patient's preceding medical and dental history was non-contributory. Diet history revealed frequent snacking and nocturnal bottle feeding of sweetened milk. Clinical examination revealed grossly carious 51 52 54 61 62 63 64, deep dentinal and multisurface caries was present in 53 73 74 75 84 85 (Figure 1B to 1F). Smooth surface caries involving enamel was present in 71 72 73 81 82 83 (Figure 1F). Following radiographic investigations involving orthopantomogram (Figure 1G) and intra oral periapical radiographs, carious lesion approximating the pulp with periradicular radioluscency in 53 74 75 85 was evident. Diagnosis of Severe Early Childhood Caries was arrived at.

Treatment objectives were planned accordingly and discussed with the parent and the consent was obtained. The treatment procedure carried out in a specific order was done in multiple visits and has been outlined as follows.

1. Medications including antibiotics and analgesics were prescribed. Oral prophylaxis was carried out. Parent was advised regarding the child's oral hygiene maintenance.
2. Extraction of 54 and 64 for prioritizing the chief complaint of the child.
3. Pulpectomy of 53 74 75 85.
4. Restoration of 71 72 73 81 82 83 84.
5. Extraction of 51 52 61 62 63.
6. Adaptation and cementation of stainless steel crowns (SSCs) with respect to 74 75 84 85.
7. Fabrication and cementation of Groper appliance following impression making of both the arches.
8. Fluoride application and reinforcement of oral hygiene instructions.

In order to augment the cooperation of the patient, various behaviour management techniques were employed in the ensuing visits like tell-show-do, use of euphemisms, voice control, positive reinforcement etc. According to the outlined treatment plan, extractions and pulpectomies were carried out under local anaesthesia (2% lidocaine with 1:80,000 epinephrine (Xicaine; ICPA Health Products Ltd., Mumbai, India). For teeth undergoing pulpectomy procedure, obturation of the canals were done with metapex (DiaPex® Plus; DiaDent Group International, Cheongju-si, Korea) and access cavity build up was done with Type 9 Glass Ionomer Cement (XtraCem, Shade A2; Medicept UK Ltd., Harrow, UK). Teeth affected with Smooth surface caries were restored using light cure packable composite resin ((Ivoclar Vivadent, Liechtenstein) following caries excavation.

Fabrication of Modified Groper's appliance

Stainless steel band adaptation in 55, 65 was done with optimal marginal fit. Impression of both the maxillary and mandibular arches were made with alginate (Algitex, Dental Products of India, Mumbai, India). The bands were transferred onto the impression and secured using pin method. Following which master cast was made with type 2 dental stone (BN Chemicals, West Bengal, India). Bite registration was done after fabrication of a customized tray (Figure 2A) with self-cure acrylic resin (DPI RR cold cure, Dental Products of India, Mumbai, India) and occlusal rim with modelling wax (The Hindustan Dental Products, Hyderabad, India). Articulation of both maxillary and mandibular casts along with the transfer of the registered bite was done (Figure 2B, 2C). The wire component, comprising of a 20 gauge/0.9mm diameter stainless steel wire was adapted along the contour of the maxillary arch in the maxillary master cast in a zig-zag pattern extending from the palatal surface of banded 55 to palatal surface of banded 65. Once stabilised, the wire component was soldered to the bands (Figure 2D). Teeth 54, 52, 51, 61, 62, 63, 64 which were missing were replaced by preformed acrylic teeth. Shade matching for the acrylic teeth was one prior using ceramic shade guide (Vita, VITA Zahnfabrik, Germany). Teeth setting according to proper occlusion was carried out (Figure 2E to 2G). The procedure of flasking using closed method followed by dewaxing in hot water bath at 90°C-100°C for 15-20 minutes was carried out. Packing was done using heat cure acrylic resin (DPI Heat Cure, Dental Products of India, Mumbai, India) followed by curing in hot water bath at 90°C-100°C for 45 minutes. Deflasking followed by finishing and polishing of the appliance was done (Figure 2H). Cementation of the appliance was carried out using Type I Glass Ionomer Cement (Hy-Bond Glasionomer CX-Smart, Shofu Inc, Japan). The occlusion was checked carefully. Postoperative pictures were taken (Figure 3A to 3E) and an orthopantomogram was advised (Figure 3G). Parents were made aware of dietary management and oral hygiene instructions were reinforced.

The child was recalled after 7 days, 1 month and thereafter every 3 months for 1 year. No dislodgement nor any signs of failure of the appliance was noted. Figures 4A to 4D reveals the intraoral and extraoral pictures after 1 year follow up visit. The parents were pleased with the improved facial esthetics of the child. They also reported of increased masticatory efficiency and improvement of psychological behavior as the child's willingness to mingle among the peer groups had increased.

III. DISCUSSION

Premature exfoliation of tooth implies that the primary tooth is lost when the development of the succeedaneous permanent tooth bud has not crossed Nolla's sixth stage which is marked by completion of coronary portion and initiation of eruptive movements [7]. Premature exfoliation of deciduous anterior teeth may affect a patient's speech evolution [8]; formation of the permanent succeedaneous teeth and their eruption [9]; hindering arch integrity; inception of non- nutritive oral habits like digital sucking, tongue thrusting; thus leading to development of malocclusion in secondary dentition [10]. The most appropriate space maintainer for a pediatric patient is the fixed type, as they are readily accepted. This stands in contrast to removable esthetic appliances as pediatric patients in this age group are less compliant with its usage and there remains a risk of deglutition [3].

Along with children having seizure disorders, immunocompromised status, mental retardation, substantial deepbite, overjet, or anterior crossbite issues, the forewarnings for placement of anterior fixed appliances also comprises challenges in follow-up, inadequate hygiene, and inappropriate feeding habits [11]. Therefore, following a thorough evaluation of the parent's interest in both the aesthetics and dental health of the child, the implementation of this appliance was carefully planned.

Changes in dental arch pose to be constraints in the use of fixed prosthesis as the dynamics of occlusion change from primary to mixed dentition. However, between the age of 2 to 5.5 years of age there is insignificant change in the dimensions of the dental arches. In this age, the growth in the intercanine region is clinically insignificant and is nominal as it is less than 0.5mm. The appliance fabrication in this case was performed on a patient approaching the stable phase; thus, it was a suitable and steady time frame for such an intervention [12]. Removal of this fixed appliance may be done after the eruption of permanent first molar as changes in arch length would occur and the primary incisors would be nearing its exfoliation time [5]. In a study by Kalia et al. [13], children with missing maxillary anterior teeth were monitored for speech changes before and after prosthetic rehabilitation with fixed functional space maintainers. Their study depicted substantial misrepresentations and pronunciation errors of 'v', 'd', 'dh', 't', 'th', 's', and 'sh' consonants. The articulation errors got amended postoperatively after the placement of fixed appliances in children with at least two missing maxillary anterior teeth, in the age ranging from 3 to 6 years. A meta-analysis depicted that the early exfoliation of deciduous anterior teeth could lead to distortion of speech [14]. Therefore, providing this appliance was crucial for preserving the patient's speech efficiency.

Regardless of this, the few studies that have been published in the literature that have examined the effects of early loss or extraction of primary anterior teeth have methodological inadequacies, poor evidence-based quality, and are based on obsolete research [14].

More commonly, premature loss/extraction of primary anterior teeth has been documented to initiate abnormal swallowing pattern, often leading to tongue thrusting habit aided by the unnatural space created. Persistent changes may result in delayed nasal breathing, respiratory dysfunction, and possibly the development of mouth breathing. Numerous studies have shown that as a result of premature tooth loss, in order to achieve an occlusal contact during mastication, a child may protrude or deviate the mandible which leads to a rise in the percentage of class III malocclusion [15],[16].

A meta-analysis strongly supports the association between malocclusion in the permanent dentition and the early loss of primary teeth. Remarkably, there was a strong correlation between Class III malocclusions and early loss of primary teeth [17].

The initial Groper's appliance, as introduced by Jasmin and Groper in 1984, featured acrylic teeth affixed to metal clefts that were soldered onto the palatal wire [18]. The wire can be soldered to either SSCs or prefabricated stainless steel bands adapted to primary first or second deciduous molars [5]. Recognizing the challenges posed by complex laboratory procedures, the appliance underwent modifications, incorporating preformed acrylic teeth and an acrylic flange [19], [20]. Chalakkal P et al.[19] used trimmed acrylic teeth having retention holes palatally to incorporate the acrylic. Shanmugaavel AK et al.[20] retained the roots of the primary incisors with the coronal structure damaged till CEJ. Pulpectomy was carried out for the retained roots. The appliance incorporated a palatal wire soldered to stainless steel crowns in primary molars and tooth colored heat cure acrylic teeth with a short palatal acrylic flange resting over the pulpectomy treated roots of the incisors. Another case report highlighted use of light cured composite teeth built onto the cleats formed by the palatal wire [21]. Saini et al. [6] used an additional wire component along with the palatal wire, incorporating retentive tags in the palatal region of the missing teeth which was subsequently embedded in acrylic flange. Composite build up of the missing teeth were done. In all the other case studies mentioned, the appliance was of short span involving

only incisors. The case discussed here describes the fabrication of a long span modified Groper appliance replacing anterior teeth as well as posterior deciduous molars for restoration of function and esthetics. The buccal flange extended till the buccal and the labial sulcus and the palatal flange extended till the maxillary first deciduous molar region. This appliance provides numerous benefits, including restoration of masticatory and speech efficiency, improvement in aesthetics, and prevention of abnormal oral habit development and class III tendency as discussed before.

Limitation

Use of a fixed appliance augments the build-up of food debris and plaque. Hence, it is imperative that parents recognize that the utilization of fixed appliances necessitates meticulous attention to mitigate the advancement of caries. An extensive caries prevention program must commence with a regular recall schedule. Before planning for a fixed appliance in paediatric patient, a modified, less cariogenic diet and proper oral hygiene practices should be implemented.

IV. CONCLUSION

Prompt and early interventions can aid in lessening the psychosocial challenges concomitant to premature loss of primary teeth. This case report discusses the fabrication and the rationality behind the use of a fixed long span modified Groper's appliance in a toddler. It provided a psychological boost to the child suffering from ECC as it restored the function as well as esthetics. Even though it has its limitations as discussed, the outcome was advantageous and no adverse consequences were perceived in the subsequent recall visits.

AUTHORS' CONTRIBUTIONS
BC (Investigation; Methodology; Writing – original draft; Writing – review & editing)
AB (Conceptualization; Methodology; Supervision; Writing – review & editing)
CG (Resources; Supervision; Writing – review & editing)
JP (Methodology; Resources; Writing – review & editing)
SS (Investigation; Resources; Methodology)

CONFLICTS OF INTEREST
The authors of this article declare no conflict of interest.

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FIGURES

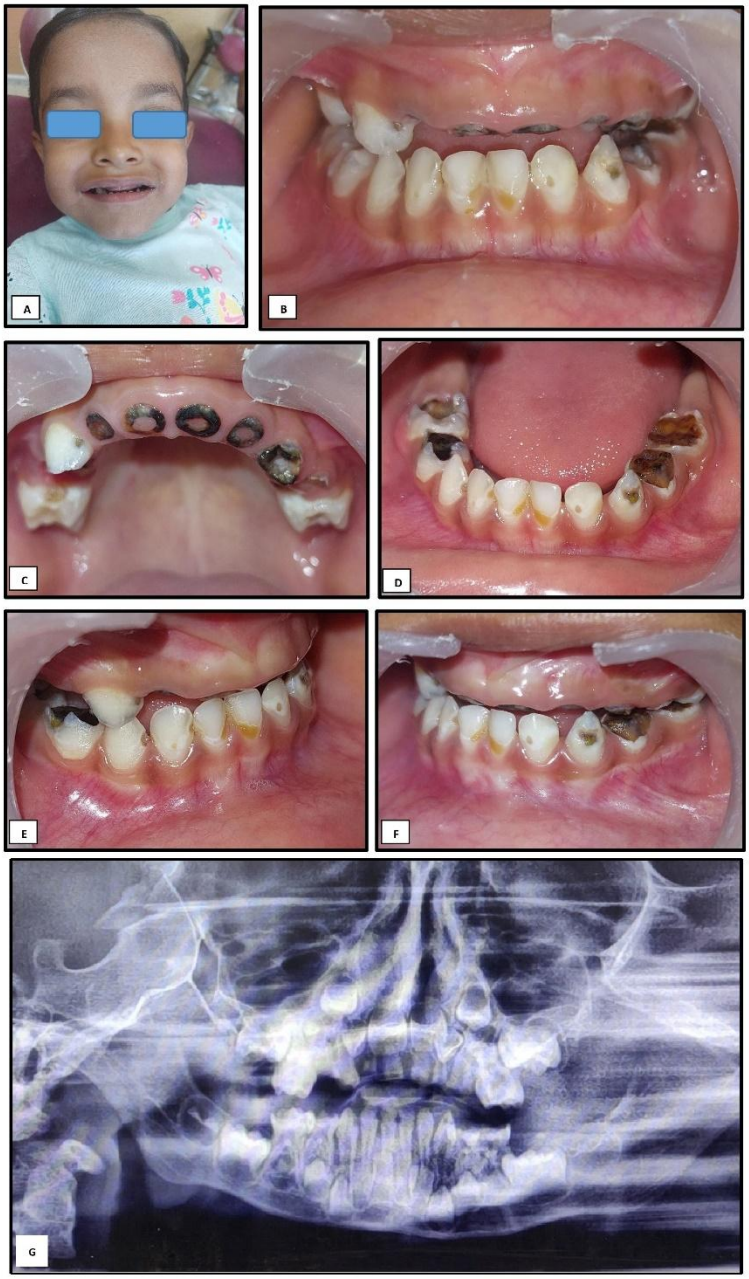

Figure 1: Preoperative records of the patient. 1A: Preoperative smile of the patient. 1B: Intraoral frontal view. 1C: Maxillary arch.1D: Mandibular arch. 1E: Occlusion of the right side. 1F: Occlusion of the left side. 1G: Orthopantomogram revealing multiple root stumps and carious teeth.

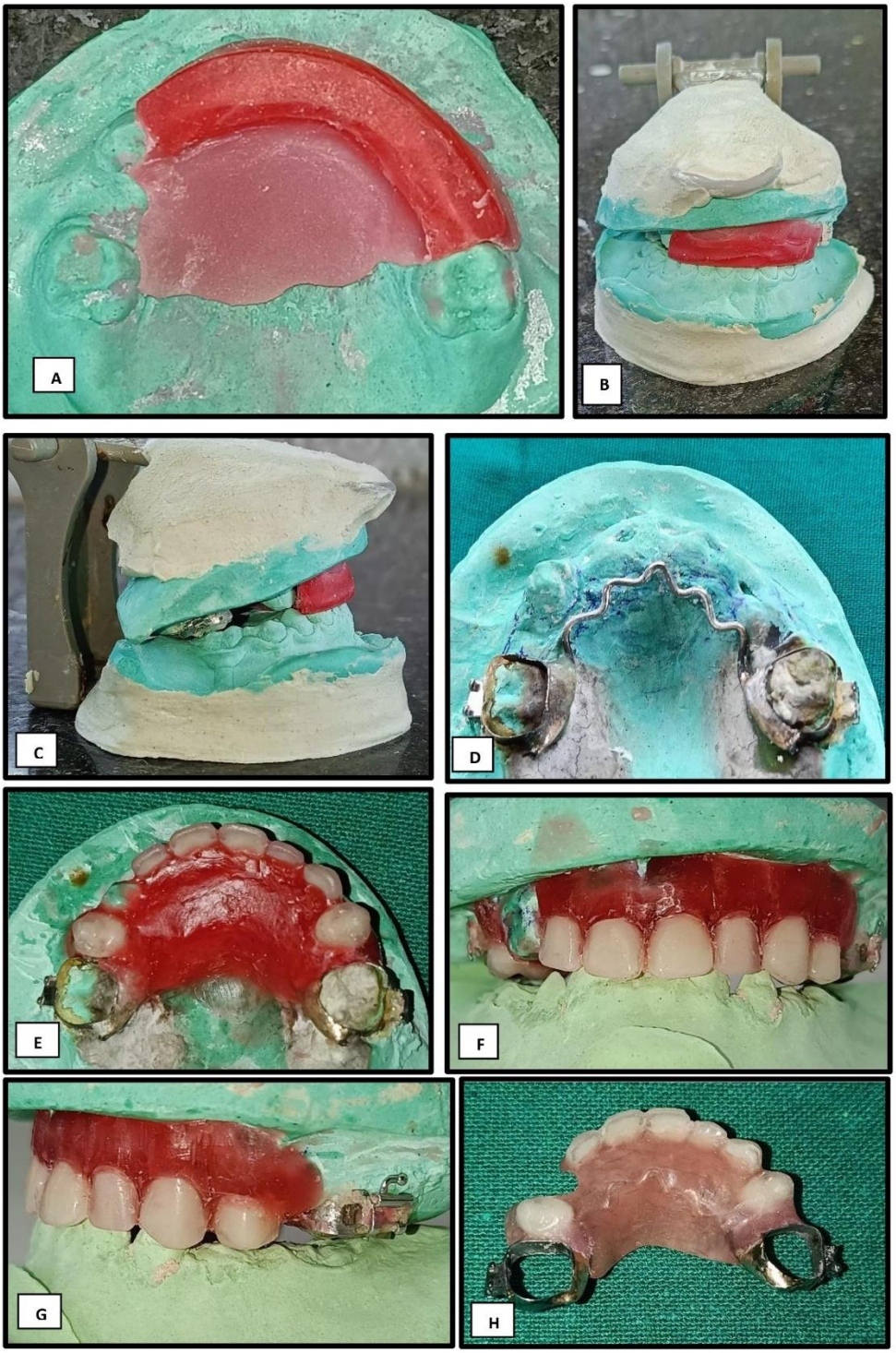

Figure 2: Steps depicting fabrication of modified Groper appliance. 2A: Fabrication of a customised tray using self cure acrylic resin and occlusal rim using modelling wax. 2B & 2C: Articulation of maxillary and mandibular casts following bite registration. 2D: A 20 gauge/0.9mm diameter stainless steel wire adapted along the contour of the maxillary arch in the maxillary master cast in a zig-zag pattern extending from the palatal surface of banded 55 to palatal surface of banded 65. 2E, 2F, 2G: Teeth setting done according to proper occlusion. 2H: Modified Groper appliance following finishing and polishing.

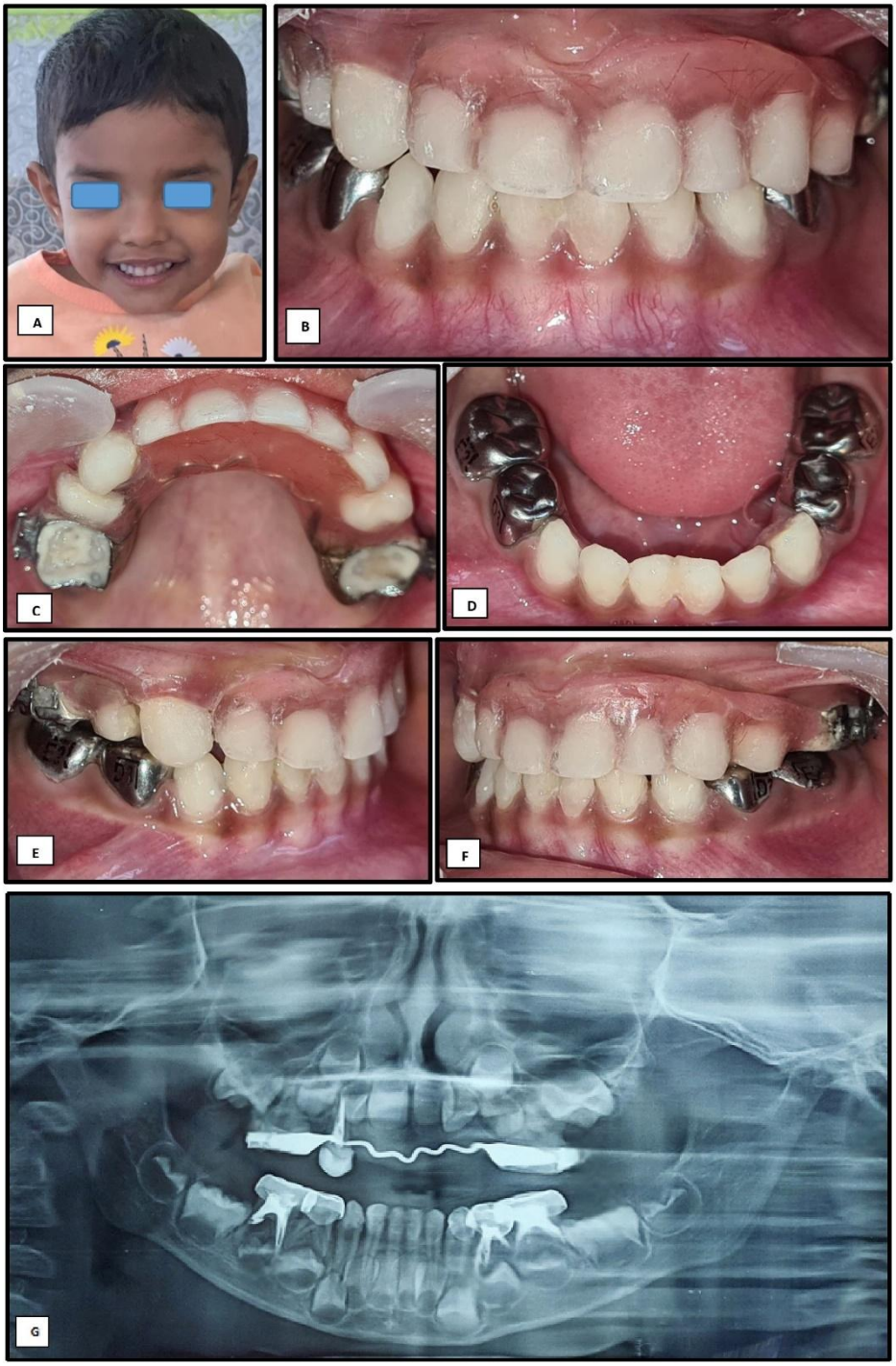

Figure 3: Postoperative records of the patient. 3A: Postoperative smile of the patient with improved facial esthetics. 3B: Intraoral frontal view. 3C: Maxillary arch with the cemented Groper appliance. 3D: Mandibular arch with stainless steel crowns adapted on 74, 75, 84, 85. 3E: Occlusion of the right side. 3F: Occlusion of the left side. 3G: Orthopantomogram revealing pulpectomy treated 53, 75, 85. Stainless steel crowns on 74, 75, 84, 85. Cemented Modified Groper appliance.

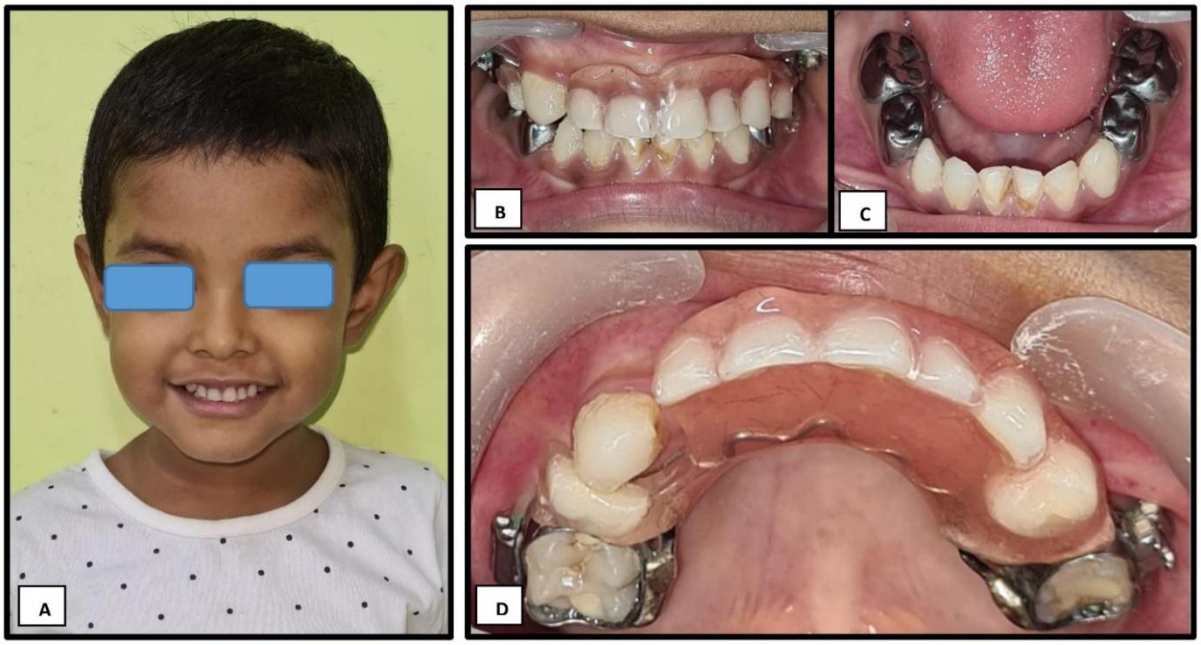

Figure 4: Records of the patient at the 1 year follow up visit. 4A: Esthetic smile of the patient. Figure 4B, 4C, 4D: Intraoral frontal view and maxillary and mandibular arches show no dislodgement nor any signs of failure of the appliance and intact stainless steel crowns in the lower arch.