**Review Article**

International Journal of Dental and Health Sciences
Volume 11,Issue 03

# SHOWCASING GROPER'S APPLIANCE: DEVELOPMENTS IN AESTHETIC AND FUNCTIONAL ENHANCEMENT FOR PEDIATRIC DENTAL PROSTHETIC PATIENTS

**Richa Wadhawan[1], Yashvardhan Shrivastava[2], Kartik Sinha[3], Devika Agrawal[4], Ruchi Agrawal[5], Girija Gahlot[6], Nayanlata Saxena[7]**

1. Professor, Oral Medicine, Diagnosis & Radiology, PDM Dental College & Research Institute, Bahadurgarh, Haryana
2. Dental Surgeon, Neelkanth Oral And Dental Clinic, Lalitpur, Uttar Pradesh
3. Post Graduate, Paediatric And Preventive Dentistry , Hitkarini Dental College And Hospital, Jabalpur, Madhya Pradesh
4. Post Graduate, Paediatric And Preventive Dentistry , Hitkarini Dental College And Hospital, Jabalpur, Madhya Pradesh
5. Post Graduate, Paediatric And Preventive Dentistry , Maharana Pratap College Of Dentistry & Research Centre, Gwalior, Madhya Pradesh
6. Dental Surgeon, Dr Girija's Dental Clinic, Jodhpur, Rajasthan
7. Medical Offficer, Datia District Hospital,Datia, Madhya Pradesh

## ABSTRACT:

The Groper's appliance represents a significant advancement in pediatric dental prosthetics, designed to address the complex needs of children with missing anterior teeth. Its innovative design combines acrylic teeth with metal cleats attached to a palatal wire, offering both a natural appearance and effective gap-filling. This design enhances aesthetic appeal, masticatory function, and speech development, thus improving the overall well-being of young patients. Despite these benefits, the appliance presents challenges such as space requirements, oral hygiene maintenance, and potential durability issues. Additionally, the Groper's appliance plays a crucial role in orthodontics by managing malocclusions, misaligned arches, and the eruption of permanent teeth. Modifications to the appliance for prosthetic rehabilitation of missing primary anterior teeth in preschoolers, often due to physical activity or developmental challenges, are also discussed. Case studies and research validate the appliance's effectiveness and its modifications in achieving desirable outcomes. The discussion includes challenges related to patient compliance and the necessity for regular adjustments, with strategies provided to optimize performance. Overall, Groper's appliances are essential in pediatric orthodontics and prosthetics, offering significant benefits for early intervention, effective treatment, and long-term dental health.

Keywords: Gropers Appliance, Space Maintainers, Anterior Teeth, Aesthetics, Rehabilitation, Child, Deciduous, Avulsion, Treatment

## INTRODUCTION:

Children's playful activities, whether it's cricket, soccer, kabaddi, or hide and seek, can often lead to accidents, particularly during their early developmental stages when they begin crawling, standing, or walking. Such recklessness frequently results in traumatic injuries, including the loss of anterior teeth. [1] For pediatric dentists, restoring both the aesthetics and function of these lost teeth in preschoolers, due to severe early

*Corresponding Author Address: Dr. Richa Wadhawan E-mail: wadhawanricha1@gmail.com

childhood caries (ECC) or trauma, is a significant challenge.[2] Early loss of teeth has profound and lasting effects on a child's oral health. It impacts the alignment and spacing of both primary and permanent teeth, often leading to undesirable shifts and loss of arch length.[3] Premature loss of maxillary incisors due to caries is particularly prevalent among young children. ECC, formerly known as baby bottle caries or nursing bottle tooth decay, is marked by rampant dental decay in infants and toddlers. This decay can advance to the point where most anterior crowns are severely damaged or lost by the time dental care is sought.[4] Prolonged exposure to sugary nursing bottles, especially those containing fermentable carbohydrates, creates a highly conducive environment for tooth decay.[5] The sugary liquid pools around the maxillary incisors, exacerbated by reduced salivary flow during sleep, poor oral hygiene, and unrestricted nighttime feeding, significantly increases the risk of caries.[6]These lesions typically start on the labial surfaces of anterior teeth and progress rapidly, leading to severe destruction of primary anterior teeth.[7] The early loss of anterior teeth profoundly affects a child's psychological well-being.[8]Therefore, rehabilitating both aesthetics and function is crucial. Prosthetic replacements must be carefully designed to ensure they do not interfere with the eruption of permanent successors. Several aesthetic solutions, including removable and fixed partial dentures, can effectively address these concerns.[9]Restoring lost teeth and managing prosthetics is vital for maintaining function, appearance, and psychological well-being while ensuring that replacements do not disrupt the eruption of the underlying permanent teeth.[10] Several types of space maintainers are available, selected based on the child's dental development, which arch requires them, and which primary teeth are missing. Understanding the growth and development of a child's dental arches is crucial for selecting the appropriate space maintainer.[11] Key factors include occlusion and the patient's cooperation and tolerance for the appliance. Premature loss of primary teeth can lead to unwanted drifting and space loss in the arch.[12] Installing space maintainers immediately after the loss of primary teeth can prevent these issues and avoid malocclusion.[13] Essential requirements for a space maintainer include maintaining space, preventing over-eruption of antagonist teeth, restoring function, allowing for maxillary growth, maintaining hygiene, and being durable and cost-effective.[14]Premature loss of primary teeth can result in various dental malocclusions, including midline shifts, space loss, and crowding.[15] Anterior tooth loss can lead to tipping of adjacent teeth, over-eruption of antagonist teeth, midline deviation, impaired mastication, speech problems, and lingual dysfunction.[16]Space maintainers address these malocclusions by preserving space and guiding the eruption of permanent teeth into their proper positions. In pediatric dentistry,

the loss of teeth due to necrosis contributes to space loss. [17]The early loss of primary molars is a serious concern in pedodontics. Factors such as decreased fluoride concentration and dental plaque accumulation can elevate caries risk. Pulpectomy can help preserve primary teeth and avoid extraction. Deciduous teeth, often seen as “temporary,” are crucial for mastication, phonetics, general health, aesthetics, self-esteem, and psychological comfort.[18] Their premature loss impacts a child’s nutrition, sleep, growth, and self-confidence, leading to issues such as speech problems, masticatory inefficiency, abnormal oral habits, and unesthetic appearance.[19]The Groper's appliance is a specialized space maintainer designed for children who have lost their primary anterior teeth due to accidents or caries. This fixed partial denture addresses aesthetic concerns, restores mastication and speech, prevents abnormal oral habits, and maintains appearance.[20] The absence of maxillary anterior teeth, which play a crucial role in phonetics, can lead to speech issues affecting sounds like‘s,’ ‘z,’ and ‘th.’ Aesthetic rehabilitation of the primary dentition is essential for restoring the child's self-esteem. [21]The Groper's appliance was first documented by Jasmin and Groper in 1984.[22] Its primary objectives were to assist in space maintenance, improve aesthetics, and support speech development. [23]The appliance can be customized based on the patient’s needs. Early designs featured teeth attached directly to metal cleats soldered to a palatal wire bar. Later advancements included the development of the GRASCE appliance by Shanmugaavel et al., which used a palatal wire to attach the teeth directly and replaced molar bands with stainless steel crowns.[24]This design modification improved the appliance's fit and durability. The evolution of the Groper's appliance reflects a broader trend in pediatric dentistry toward more effective and patient-friendly solutions, addressing the unique needs of young patients and contributing positively to their overall well-being and development.[25] In the early 20th century, pediatric dental prosthetics were rudimentary, typically consisting of simple removable devices or basic partial dentures before the advent of specialized appliances like the Groper's.[26]These early solutions lacked the advanced design features required for effective function and aesthetic appeal in children.[27] By mid 20th Century advancements in Design saw significant progress in dental prosthetics, driven by improved materials and techniques. These advancements laid the groundwork for more specialized and effective appliances, including those tailored for pediatric use.[28]

## DISCUSSION:

The primary factor influencing the decision to place an anterior esthetic appliance is parental preference.[29] Although there is no strong evidence suggesting that the early loss of maxillary

incisors adversely affects a child's overall growth and development, there are significant considerations, including speech difficulties, masticatory inefficiency, abnormal oral habits, and aesthetic concerns.[30] One of the key concerns with the loss of primary incisors is its potential impact on speech development. Many speech sounds involve the tongue interacting with the maxillary incisors.[31]Missing incisors can lead to incorrect speech compensations. Riekman and Badrawy in 2001 found that the loss of primary anterior teeth before the age of 3 years can result in speech problems, particularly with labiolingual sounds.[32] The Groper's appliance helps in maintaining proper speech development by providing a substitute for the missing teeth, thereby reducing the need for compensatory speech patterns.[33]Nair et al. in 2018 highlighted the role of space maintainers, including the Groper's appliance, in mitigating speech issues caused by missing anterior teeth.[34] The Groper's appliance effectively restores the aesthetic appearance of anterior teeth, which is crucial for maintaining a child's self-esteem and social interactions.[35] For instance, Riekman and Badrawy in 2001 emphasized that the early loss of primary anterior teeth can create noticeable gaps affecting a child's appearance and confidence.[36] The Groper's appliance also contributes to improved masticatory efficiency by filling gaps left by lost teeth. Effective chewing is essential for a child's nutrition and overall health. Studies have demonstrated that appliances like the Groper's device contribute to better masticatory function, which is crucial for growth and development.[37] Panchal et al.in 2019 noted that maintaining proper masticatory function with prosthetic replacements helps prevent nutritional deficiencies in children with missing teeth.[38]Functioning as a space maintainer, the Groper's appliance is critical for preventing undesirable tooth movements and malocclusions resulting from the premature loss of primary teeth. It helps maintain arch length and proper alignment of the remaining teeth, reducing the need for complex orthodontic treatments later. Potgieter in 2018 highlighted that space maintainers like the Groper's appliance play a crucial role in preventing malocclusions due to early tooth loss.[39] The psychological impact of tooth loss on young children can be significant. The Groper's appliance improves the aesthetics of a child's smile and restores their ability to speak and eat properly. The positive psychological effects of using such appliances have been well-documented.[40]Govindaraju et al. in 2017 found that early replacement of lost teeth with esthetic appliances helps maintain a child's self-esteem and social interactions.[41]Recent studies have focused on improving the design of the Groper's appliance, such as incorporating preformed acrylic teeth and better stabilization methods. These advancements address earlier limitations related to durability and comfort.[42] Shanmugaavel et al. in 2019

demonstrated that modern modifications to the Groper's appliance enhance its functionality and patient acceptability, making it a preferred choice in pediatric dentistry.[43] The fabrication of a Groper's appliance is a meticulous process designed to restore missing anterior teeth with a focus on esthetics and functionality. It begins with a thorough clinical examination, including a review of the child's dental history and diagnostic radiographs to assess the underlying bone structure and any potential issues.[44] Following this, treatment planning involves discussing the need for an esthetic appliance with the parents, determining the appropriate design and materials.[45] Accurate impressions of the maxillary arch are then taken, followed by a bite registration to capture occlusal relationships and the position of adjacent teeth. These impressions are used to create diagnostic casts, which guide the design of the appliance—a combination of acrylic teeth and a metal framework.[46]The metal framework, typically made from stainless steel or other biocompatible metals, is crafted using lost-wax casting techniques to ensure a precise fit, while the acrylic teeth are custom-made to match the child's natural dentition and attached to the framework with dental acrylic resin.[47]After construction, the appliance is fitted in the child's mouth, with adjustments made to ensure comfort, proper alignment, and functionality. The appliance is then polished to minimize plaque buildup.[48]Parents are instructed on proper cleaning and maintenance, and regular follow-ups are scheduled to monitor the appliance's performance and make adjustments as needed. Comprehensive documentation of the fabrication process, patient interactions, and follow-up care is maintained to ensure continuity and quality of care.[49]

**Future Directions:** Future research and developments will likely focus on addressing these limitations. Enhancements in design, such as improved materials and stabilization methods, are expected to refine its functionality and patient acceptability. Studies should continue to explore its long-term efficacy and potential improvements, considering diverse patient populations to optimize its application in clinical practice.[50]

## CONCLUSION:

The Groper's appliance represents a significant advancement in pediatric dental prosthetics, merging innovative design with functional benefits to address the needs of young patients. By effectively restoring missing anterior teeth, it enhances aesthetics, improves masticatory efficiency, and supports speech development, playing a vital role in the overall well-being of children. Despite its natural appearance and functional restoration, the appliance has limitations, such as the need for adequate space and potential complications with oral hygiene and durability. Nonetheless, its balanced approach to both esthetic and functional concerns makes it a valuable tool in

pediatric dentistry. Future developments and research will likely focus on overcoming these challenges, refining the design, and exploring long-term efficacy to better serve diverse patient populations and enhance its clinical application.

## REFERENCES:


1. Waggoner WF, Kupietzky A. Anterior esthetic fixed appliances for the preschooler: considerations and a technique for placement. Pediatr Dent. 2001; 23(2):147–50.
2. Sharma MP, Srivastava B, Gupta N, Gambhir N, Singh R. Esthetic & Functional Rehabilitation in a Four Year Old Pediatric Patient with Modified Groper's Appliance - A Case Report. J Clin Dent Heal Talk.2019; 11(4):46–8.
3. Joybell CC, Ramesh K, Simon P, Mohan J, Ramesh M. Dental rehabilitation of a child with early childhood caries using Groper's appliance. J Pharm Bioallied Sci. 2015; 7:S704. 7406.163483.
4. Liegeois F, Limme M. Modified bonded bridge space maintainer. J Clin Pediatr Dent. 1999; 23:281–4.
5. Chalakkal P, Devi RS, Srinivas GV, Venkataramana P. Dentulous appliance for upper anterior edentulous span. J Clin Diagn Res. 2013; 7(12):3086.
6. Gable TO, Kummer AW, Lee L, Creaghead NA, Moore LJ. Premature loss of the maxillary primary incisors: Effect on speech production. ASDC J Dent Child. 1995; 62:173 9.
7. Parihar V, Choudhary R, Singh V, Sihag T, Malhotra R. Groper' S Appliance. An Anterior Fixed Aesthetic Appliance. 2017; 1(1):1–4.
8. Borum MK, Andreasen JO. Sequelae of trauma to primary maxillary incisors. Complications in the primary dentition. Endod Dent Traumatol. 1998; 14: 31-44.
9. Laing E, Ashley P, Naini FB, Gill DS. Space maintenance. International Journal of Paediatric Dentistry. 2009; 19(3):155-62.
10. Wilson, CFG. Management of trauma to primary and developing teeth. Dental Clinics of North America. 1995; 39: 133-167.
11. Jasmin JR, Groper JN. Fabrication of a more durable fixed anterior esthetic appliance. J Dent Child. 1984; 51:124 7.
12. Kirzioglu Z, Erturk MS. Success of Reinforced Fiber Material Space Maintainers. J Dent Child. 2004; 71: 158- 62.
13. Koroluk LD, Riekman GA. Parental perceptions of the effects of maxillary incisor extractions in children with nursing caries. J Dent Child. 1991; 58: 233-36.
14. Waggoner W, Kupietzky A. Anterior esthetic fixed appliances for the preschooler: considerations and a technique for placement. Pediatr Dent. 2001; 23(2):147-50.
15. Jabin Z, Dudeja P, Dudeja K. Management of bilateral dental agenesis with aesthetic rehabilitation by Groper's appliance – A six year follow up. J Clin Diagn Res. 2021; 14:01 3.
16. Seth MP, Rani ST, Merum K, Raju S. Fix smile for a while: An esthetic rehabilitation with Groper's appliance – Two case reports. Indian J Dent Adv. 2018; 10:119 21.

17. Ngan P, Wei SH. Management of space in the primary and mixed dentitions. In: Pediatric Dentistry: Total Patient Care. Philadelphia, PA: Lea and Febiger. 1988; 462 70.
18. Riekman GA, el Badrawy HE. Effect of premature loss of primary maxillary incisors on speech. Pediatr Dent. 1985; 7: 119 22.
19. Aldrigui et al. Impact of traumatic dental injuries and malocclusions on quality of life of young children. Health Qual Life Outcomes 2011; 9(9):78-84.
20. Andreason JO. Traumatic injuries of the teeth.2nd ed.Copenhagen: Munksgaard;1981.
21. McGrath C, Broder H, Wilson-Genderson M. Assessing the impact of oral health on the life quality of children: implications for research and practice. Community Dent Oral Epidemiol. 2004; 32:81–5.
22. Jasmin JR, Groper JN. Fabrication of a more durable fixed anterior esthetic appliance. J Dent Child. 1984; 51(2):124-7.
23. Steffen JM, Miller JB, Johnson R. An esthetic method of anterior space maintenance. J Dent Child. 1971; 38(3):154-7.
24. Shanmugaavel AK, Gurunathan D, Sundararajan L. Smile reconstruction for the preschoolers using GRASCE appliance – Two case reports. J Clin Diagn Res. 2016; 10:ZD19 22.
25. Klapper BJ, Strizak-Sherwin R. Esthetic anterior space maintenance. Ped Dent. 1983; 5(2):121-123.
26. Locker D, Jokovic A, Stephens M, Kenny D, Tompson B, Guyatt G. Family impact of child oral and oro-facial conditions. Community Dent Oral Epidemiol. 2002; 30:438–48.
27. Fymbo L. The relation of malocclusion of the teeth to defects of speech. Arch Speech. 1936; 1:204-16.
28. Goenka P, Sarawgi A, Marwah N, Gumer P, Dutta S. Simple Fixed Functional Space Maintainer: A Case Report. Int J of ClinPediatr Dent. 2014; 7(3):225-228.
29. Goel D, Goel G. Restoring Esthetics after Anterior Tooth Loss for a Five-Year-Old Child: Natural Tooth Pontic Fiber Reinforced Prosthesis. Case Rep Dent.2013:215816.
30. Prabhakar M, Kaur M. Prosthetic replacement options for premature loss of deciduous anterior teeth. Indian Journal of Dental Sciences. 2014; 4(6):55-57.
31. Joybell CC, Ramesh K, Simon P, Mohan J, Ramesh M. Dental rehabilitation of a child with early childhood caries using Groper's appliance. J Pharm Bioallied Sci. 2015; 7(Suppl 2):S704-7.
32. Christensen JR, Fields HW. Space maintenance in the primary dentition. In: Pinkham JR, editor. Pediatric Dentistry: Infancy Through Adolescence. 2nd ed. Philadelphia: WB Saunders Company; 1994. pp. 358–63.
33. Ngan P, Wei SH. Itor. Pediatric Dentistry: Total Patient Care. Philadelphia: Lea and Febiger; 1988. Management of space in the primary and mixed dentitions; pp. 462–70.
34. Dyson JE. Prosthodontics for children. In: Wei SH, editor. Pediatric Dentistry: Total Patient Care. Philadelphia: Lea and Febiger; 1988. pp. 259–74.
35. Waggoner WF, Kupietzky A. Anterior esthetic fixed appliances for the preschooler: Considerations

and a technique for placement. Pediatr Dent. 2001; 23:147–50.
36. Riekman GA, el Badrawy HE. Effect of premature loss of primary maxillary incisors on speech. Pediatr Dent. 1985; 7:119–22.
37. R. Aniyo , G. Kaur and Neha. Groper's Appliance: Fixed Appliance For an Anterior Teeth. International Research Journal of Medical Sciences.2019; 2: 52-54.
38. Waggoner WF, Kupietzky A. Anterior esthetic fixed appliances for the preschooler: Considerations and a technique for placement. Pediatr Dent 2001; 23:147-50.
39. Gupta A, Gupta M, Gupta N, Jaiswal J, Jain K. Prosthetic treatment modalities in children. Public Health Research & Development. 2012; 3(1):8.
40. Liegeois, F. and M. Limme, 1999. Modified bonded bridge space maintainer. J. Clin. Pediatr. Dent., 23: 281-284.
41. Setia V, Pandit IK, Srivastava N, Gugnani N, Sekhon HK. Space maintainers in dentistry: past to present. Journal of clinical and diagnostic research: JCDR. 2013; 7(10):2402-5.
42. Coston, G.N. and C.F. Salinas. Speech characteristics in patients with hypohidrotic ectodermal dysplasia. Birth Defects Orig. Artic. 1988; 24: 229-234.
43. Acs G, Pretzer S, Foley M, Ng MW. Perceived outcomes and parental satisfaction following dental rehabilitation under general anesthesia. Pediatric dentistry. 2001; 23(5):419-23.
44. A aisha Aejaz, TabrezT. A, Mohsen AM and Tanveer A. Modified gropers appliance for enhanced esthetics : a case theme. Int. J. of Adv. Res.2019; 7: 254-258. (ISSN 2320-5407).
45. Hiremath S, Jairaj A. Cu-sil Denture-A Space Maintainer for Function-In Paediatric Patients. Journal of clinical and diagnostic research: JCDR. 2017; 11(3):ZD09
46. Colak H, Dulgergil CT, Dalli M, Hamidi MM. Early childhood caries update: A review of causes, diagnoses, and treatments. Journal of natural science, biology, and medicine. 2013; 4(1):29-38.
47. Kagihara LE, Niederhauser VP, Stark M. Assessment, management, and prevention of early childhood caries. Journal of the American Academy of Nurse Practitioners. 2009; 21(1):1-10.
48. Sachdev J, Bansal K, Chopra R. Effect of Comprehensive Dental Rehabilitation on Growth Parameters in Pediatric Patients with Severe Early Childhood Caries. International journal of clinical pediatric dentistry. 2016; 9(1):15-20.
49. Peretz B, Ram D, Azo E, Efrat Y. Preschool caries as an indicator of future caries: a longitudinal study. Pediatric dentistry. 2003; 25(2):114-8.
50. Andre Kramer AC, Skeie MS, Skaare AB, Espelid I, Ostberg AL. Caries increment in primary teeth from 3 to 6 years of age: a longitudinal study in Swedish children. European archives of paediatric dentistry: official journal of the European Academy of Paediatric Dentistry. 2014; 15(3):167-73.