Case Report

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Simplify your Practice with 3D Printed Space Maintainer

Abstract:

Preventive orthodontics is an aspect of pediatric dentistry, which requires exclusive set of skills and understanding to aid the patient's treatment and properly align teeth. The safest way to prevent future malocclusions from tooth loss is to place a space maintainer (SM), which is advocated to embrace the space until the eruption of succedaneous permanent teeth. SM manufacturing is a painstaking process that requires plentiful communication with the laboratory to suitably complete and provide the patient with optimal results. Band and loop SM is mostly indicated for the premature loss of single primary molar, but this appliance has a number of limitations. Digital technology has resulted in decreasing human errors by automating the dental model fabricating process with three-dimensional printing. The current paper provides an insight of the use of this new technology in pediatric dentistry for manufacturing of new type of SMs and a case report

Key-words: 3D Printing, space maintainers, digital dentistry, digitainers

Introduction:

The primary dentition plays a pivotal role in the child's growth as well as development. This targets toward not only in terms of speech, chewing, appearance, and the prevention of deleterious oral habits, but also in the guidance and eruption of permanent teeth.[1] Exfoliation of deciduous teeth to help in the eruption of permanent teeth is considered to be a normal physiological process, but when this process is disrupted due to early loss of deciduous teeth due to any reason it can lead to mesial migration of the adjacent teeth giving rise to space loss and resulting in crowding, impaction of permanent teeth, and supraeruption of opposing teeth. Safeguarding of primary teeth in the arch is the best solution and easiest to overcome all these problems. Hence, it is rightly quoted that primary teeth serve as best space maintainers for permanent dentition.[2]

Nevertheless, if premature extraction or loss of primary tooth is unavoidable, the safest option to maintain arch space is by placing a SM. The SMs maintain the space created by premature loss of primary teeth. Of the various fixed SMs, band and loop type of SMs are the most frequently used appliances.[3] In spite of good patient compliance, solder failure, caries development along the margins of band, and long lab time are some of the disadvantages associated with them.[4]

Considering the demerits of conventional appliances, there are various studies that explain the use of newer adhesive directly bonded splints, for example, glass fiber reinforced composite resins Ribbond and Everstick as fixed SMs.[5-7] Nevertheless, with these appliances, chances of polymerization shrinkage of the luting cement were not taken into consideration.

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A new technology of three-dimensional (3D) printing also known as additive manufacturing or desktop fabrication has been recently introduced. It is a process of making 3D solid objects from a digital file. The digital 3D model is saved in STL format and then sent to the 3D printer where the layer by layer design of an entire 3D object is formed. This creation of the 3D-printed object is achieved using additive processes. Each of these layers can be observed as a thin sliced horizontal cross-section of the eventual object.[8] The present paper discusses about the use of this digital technology in manufacturing SMs. To the best of authors' knowledge, there is no evidence till date on the use of 3D printing for manufacturing a SM appliance of this design in pediatric dentistry.

A case report:

A 6-year-old female patient reported to the OPD; Department of Pediatric and Preventive Dentistry complaining of missing tooth in lower right back tooth region since 10 days. Upon taking detailed history patient complained of pain in her lower back tooth region 15 days back and went to a general dentist who performed extraction of 85. (Figure-1) IOPA was done wrt 85 which showed premolar atnolla's stage 4.(Figure-2) Alginate impresions of upper and lower arch were made and poured into a stone model whichwere subjected to Moyer's mixed dentition analysis and Tanaka Johnston mixed dentition analysis, upon analysis predictive value > arch length was obtained.The cast was scanned using a 3D digital dental scanner (Medit T500, Medit Corp., Seongbuk-gu, South Korea) followed by the designing of space maintainer thinner to that of conventional SM, on the DentalCAD 2.2 Valletta (Exocad GmbH, Darmstadt, Germany). Space maintainer was printed using a titanium-based powdered metal material (Ti64 Gd23; LPW Technology Ltd., Cheshire, UK) by Micro Laser Sintering Technology which offers all benefits of an additive manufacturing process. (Figure-3, Figure-4). The printed SM was tried in the patient's oral cavity and after confirming its adaptation, followed by cementation using glass ionomer cement (Type 2; GC Fuji; Tokyo, Japan).(Figure-5) The patient was instructed not to eat or drink for 30 min and not to bite anything. The patient was recalled after 3 months.

Figure - 1

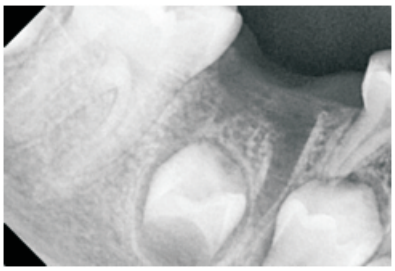

Figure - 2

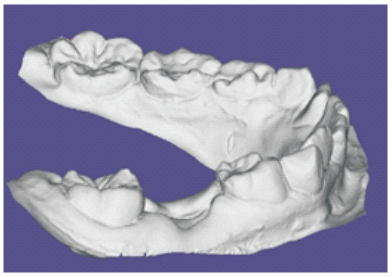

Figure - 3

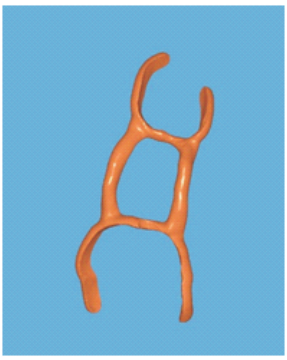

Figure - 4

Figure - 5

Discussion:

Premature loss of primary teeth in children is still very common despite scientific advances in dentistry and oral health prevention measures.[9] Maintenance of arch length during primary, mixed, and early permanent dentition after premature loss is of great significance for the normal development of future permanent occlusion.[10] Failure in maintaining the space may lead to the collapse of vertical and horizontal occlusal relationships in primary and permanent dentitions. Hence, it is very important to maintain the space present due to loss of primary tooth/teeth before normal physiologic exfoliation, until eruption of succeeding permanent dentition.[11] The use of SMs should be advocated, as it prevents dental movements and loss of perimeter helping in avoiding such complications.[12,13]

Various other disadvantages have been reported in the literature that may lead to failure of the conventional appliance.[14-17] The technology used in the current design of the SM was 3D printing, which involves the process of constructing a 3D solid object from a digital file. The whole process of taking impression of the patient, pouring cast, digitalizing it, designing the SM, and printing it by the help of 3D printer increases the precision of the appliance to the next level, minimizing human error. The extensive laboratory work, stabilizing the loop, and more importantly, soldering the loop on the band at two places and polishing, is also not required which saves time chair-side. Furthermore, the appliance is printed as one unit minimizing the breakage, thus reducing failure of the appliance. Compared to a conventional appliance, a 3D-printed model has a more complex structure with a higher level of precision.

The use of 3D printing and its advantages over conventional treatment procedure in dentistry has been reported in the literature. In oral surgery, it can be used for preparing surgical guides and conducting various blocks to augment bone defects, and for learning modules, to create the mandibles and jaws that can be easily showed to the students.[18,19] The use of 3D printing technology has also gained popularity in dental implantology due to the introduction of surgical guides to insert a dental implant.[20]

Conclusion:

Conventional band and loop has long been used for maintaining space, but certain disadvantages such as tendency for disintegration of cement and increased chairside and laboratory time make it a cumbersome procedure. The presented innovative digital design of 3D-printed SM is precise, quick, and easy. Development and perfection of 3D printing technology would allow production of information in three dimensions with accuracy. There is a huge potential in the application of 3D printing for pediatric dentistry that is yet to be explored.

References:

1. Barbería E, Lucavechi T, Cárdenas D, Maroto M. Free-end space maintainers: Design, utilization and advantages. J Clin Pediatr Dent 2006;31:5-8.
2. Setia V, Pandit IK, Srivastava N, Gugnani N, Sekhon HK. Space maintainers in dentistry: Past to present. J Clin Diagn Res 2013;7:2402-5.
3. Wright GZ, Kennedy DB. Space control in the primary and mixed dentitions. Dent Clin North Am 1978;22:579-601.
4. Kirzioğlu Z, Ertürk MS. Success of reinforced fiber material space maintainers. J Dent Child (Chic) 2004;71:158-62.
5. Karaman AI, Kir N, Belli S. Four applications of reinforced polyethylene fiber material in orthodontic practice. Am J Orthod Dentofacial Orthop 2002;121:650-4.
6. Kargul B, Caglar E, Kabalay U. Glass fibre reinforced composite resin as fixed space maintainer in children 12 month clinical follow up. J Dent Child. 2005;72:109-12.
7. Kargul B, Caglar E, Kabalay U. Glass fiber reinforced composite resin space maintainer: Case reports. J Dent Child (Chic) 2003;70:258-61.
8. Sharma S, Goel S. 3D printing and its future in medical world. J Med Res Innov 2019;3:e000141.
9. Ahamed SS, Reddy VN, Krishnakumar R, Mohan MG, Sugumaran DK, Rao AP. Prevalence of early loss of primary teeth in 5-10-year-old school children in Chidambaram town. Contemp Clin Dent 2012;3:27-30.
10. Murshid SA, Al-Labani MA, Aldhorae KA, Rodis OM. Prevalence of prematurely lost primary teeth in 5-10-year-old children in Thamar city, Yemen: A cross-sectional study. J Int Soc Prev Community Dent 2016;6:S126-30.
11. Horax S. Fixed space maintainer with molar band in premature loss of primary first molar teeth (case report). J Med Nurs 2006;27:174-6.
12. Law CS. Management of premature primary tooth loss in the child patient. J Calif Dent Assoc 2013;41:612-8.
13. Qudeimat MA, Sasa IS. Clinical success and longevity of band and loop compared to crown and loop space maintainers. Eur Arch Paediatr Dent 2015;16:391-6.

14. Baroni C, Franchini A, Rimondini L. Survival of different types of space maintainers. Pediatr Dent 1994;16:360-1.
15. Thornton JB. The space maintainer: Case reports of misuse and failures. Gen Dent 1982;30:64-7.
16. Hill CJ, Sorenson HW, Mink JR. Space maintenance in a child dental care program. J Am Dent Assoc 1975;90:811-5.
17. Srivastava N, Grover J, Panthri P. Space maintenance with an innovative "Tube and loop" space maintainer(Nikhil Appliance). Int J Clin Pediatr Dent 2016;9:86-9.
18. Winder J, Bibb R. Medical rapid prototyping technologies: State of the art and current limitations for application in oral and maxillofacial surgery. J Oral MaxillofacSurg 2005;63:1006-15.
19. Sykes LM, Parrott AM, Owen CP, Snaddon DR. Applications of rapid prototyping technology in maxillofacial prosthetics. Int J Prosthodont 2004;17:454- 9.
20. Lal K, White GS, Morea DN, Wright RF. Use of stereolithographic templates for surgical and prosthodontic implant planning and placement. Part I. The concept. J Prosthodont 2006;15:51-8.