

PATIENT SATISFACTION TOWARD TWO OF POLYMERIC CAD /CAM FIXED FUNCTIONAL SPACE MAINTAINERS

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Abstract

Aim of the study: The purpose of this study was to compare two distinct polymeric materials employed as posterior fixed functional space maintainers in terms of patient satisfaction using computer-aided design or computer-aided manufacturing (CAD/CAM).. **Methods:** Thirteen children with premature bilateral loss of the first primary molar were chosen for a randomized controlled split mouth clinical experiment to compare two different polymeric materials employed as CAD/CAM posterior fixed functional space maintainers in terms of patient satisfaction.. They were assigned according to the type of material used into group (1)polyether ether ketone (PEEK) and group (2)polymethyl methacrylate (PMMA). Assessment was done through questionnaire using a 5. point Likert-type scale. Data were statistically analyzed between the paired sides using Wilcoxon Signed Rank test at P<0.05 level of significance. **Results:** There were significant increase in satisfaction to PEEK compared to PMMA sides in all items included in questionnaire: Color ,Shape ,feasibility to use brush , ability to eat and overall satisfaction. **Conclusion:** PEEK and PMMA CAD/CAM space maintainers represent esthetic alternatives to conventional space maintainer with superior patient satisfaction for PEEK space maintainer.

Key Words: CAD/CAM, PEEK, PMMA, Functional, Esthetic space maintainer

Introduction

Deciduous teeth have an important role in children's development, not only in terms of speech, mastication, and aesthetics, but also as a natural space maintainer, protecting the dental arch perimeter and preventing harmful oral habits. [1].

As a result, primary dentition is well fitted to function as the best space maintainers for permanent teeth. However, because premature loss of primary teeth is prevalent in children, the most effective, long-lasting, and cost-effective strategy to avoid future malocclusions and impairment of function is to use a space maintainer. [2,3]. Many factors should be consider when decide to use a space maintainer as position of tooth lost, time since tooth loss, development of permanent successor, the alveolar bone covering permanent successor, oral habits, and oral hygiene. [4].

The most commonly used fixed space maintainers are those made of a wire soldered to a band or a stainless steel crown. [5]. However, these fixed appliances do not retrieve normal function.

It was not the only drawback, as most parents and children are concerned about dental aesthetics. Pediatric dentists strive to achieve a balance of aesthetics and space. [6,7].

CAD/CAM technology allows dentists to create dental restorations that are free of human error and produce exceptionally pleasing results. Ceramic blocks were used at first, but they have since been replaced by polymeric blocks, which are easier to produce and repair and cause significantly less abrasion of opposing arch teeth. Although CAD/CAM restorations have been a prominent treatment option for permanent teeth in children, there are few case studies on their use in primary teeth. [8].

The goal of this study was to evaluate two different polymeric material used as CAD /CAM posterior fixed functional space maintainers in term of patient satisfaction .

Material and Methods

Ethical regulations:

Minia University's institutional ethics council accepted the current study (number 334), and children were recruited voluntarily. All procedures followed the Helsinki Declaration of 1964 and its amendments. Parents/legal guardians who elected to participate in the study signed an informed consent form that detailed all of the benefits, risks, and alternatives to the treatment being evaluated. Patients who refused the new treatment were transferred to conventional treatment regimen.

Study design

A randomized controlled split mouth clinical trial was used in this study

Randomization, allocation, and blinding:

For the eligible subject, an independent investigator devised a randomised sequence, this sequence was kept hidden from everyone involved in the study at all times. They were assigned according to the type of material used into group (1) polyether ether ketone (PEEK) and group (2) polymethyl methacrylate (PMMA). The allocation was done with the help of a printed letter that placed into an opaque envelope with a serial number on the exterior which included the child's ID, the date, and the material to be utilized. The nature of the materials was kept disguised to statisticians (single blinding).

Eligibility criteria:

Inclusion Criteria:

- Children age from 4-7 years old.
- Patients with bilateral recent premature loss of first primary molars.
- The successors of the lost primary molars were not expected to erupt within 6 months.
- No congenital absence of the successors.
- Parents and children were accepting the new treatment modality.
- History, clinical examination and radiographs revealed absence of any pathological condition.

Exclusion Criteria:

- Children with poor oral hygiene.
- Children with poor compliance.
- Uncontrolled rampant caries and/or extensive caries in abutment teeth
- Children with parafunctional oral habits.
- Space has already been lost.
- Abnormal dental conditions such as cross bite, open bite, and deep bite
- Children suffering from loss of two or more neighboring primary teeth
- Children with systemic disease

Child assessment and preparation

Before constructing space maintainers for a child who met the above criteria, a complete evaluation was performed, which included a history, clinical examination, radiography, study casts, and arch length analysis. Oral prophylaxis, dental treatment of all cavitated teeth, professional preventive measures, and counselling about oral health measures were also performed.

Clinical and laboratory procedure :

After tooth preparation, a physical impression was taken with elastomeric impression material (Elite HD, Germany), a working cast was made with high-strength dental stone, and the shade colour of the teeth was chosen. Finally, the working cast was scanned with a 3D scanner (Ineos x5 dentsply sirona).

Software was used to create the design for the space maintainer (In lab dentsply sirona, Germany). By using a CAD/CAM machine, polymeric blocks of PMAA (Poly-methyl methacrylate) and PEEK (poly ether ether ketone) were milled (dentsply sirona, Germany).

The abutment tooth was isolated, etched, and air dried after trimming, finishing, and polishing the space maintainer. The two bridges were cemented using luting Rely X Unicem resin cement (3M ESPE Dental products, St. Paul, USA) and the child's occlusion was evaluated for any premature contact (Figure 1).

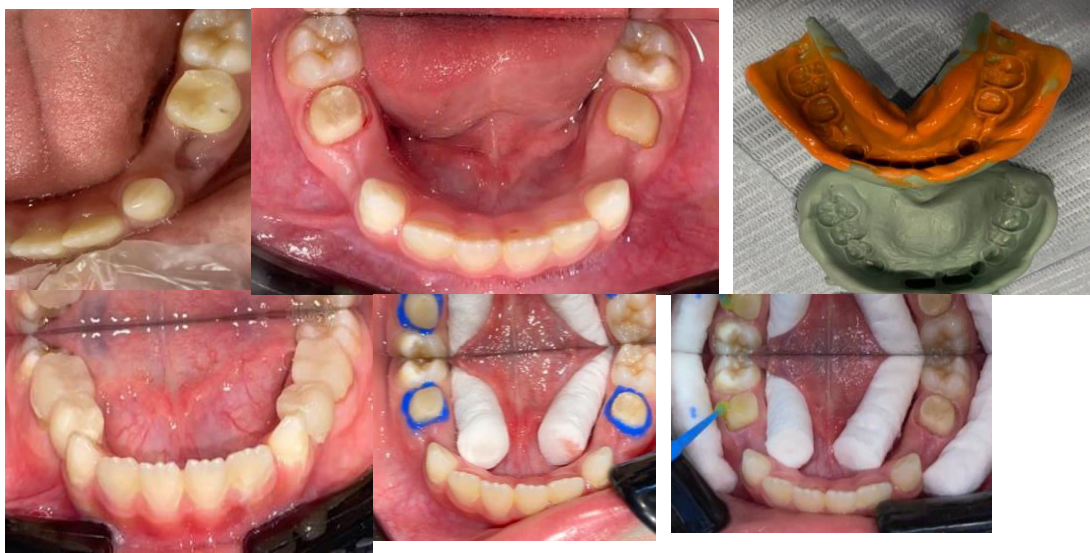


Figure (1):Clinical steps for fabrication ,preparation of abutments,impression taking,temporary bridge ,etching ,application of bond, SMs after cementation

Parent instruction

The legal guardian were advised to control their children to avert hard and sticky food and to ensure good oral hygiene. The parents were informed that the pontic will be removed by a dentist at an age of nearly 8-9 years, to allow erupting of permanent successors, and to attend immediately to the dentist in case there was any problem with the space maintainer.

Evaluation of SMs:

The patient was recalled for the first time after 24 hours, followed up for a period of one year . During evaluation and in case of failure of the appliance, the parents would freely decide to accept repair of the appliance, replacement by the same method or shifting to another regulary used method of institution where the experiment was admitted.

The patient satisfaction was evaluated via a five point Likert-type questionnaire . Parents were asked to rate :(1) Color ,(2) Shape ,(3) feasibility to brush ,(4) Ability to eat and (5) Overall satisfaction .The format of a typical five-level Likert scale was:

1. Strongly dissatisfied,2. Dissatisfied,3. Neither satisfied nor dissatisfied,4. Satisfied
5. Strongly satisfied

The obtained data were coded, tabulated, and statistically analyzed using SPSS program (Statistical Package for Social Sciences) software version 25 . For parametric (normally distributed) quantitative data, descriptive statistics were calculated using the mean, standard deviation (SD), and minimum and maximum range, whereas for qualitative data, frequency and percentage were used. The Wilcoxon Signed Rank test was used to compare the paired sides. The significance level was set at (P value < 0.05).

Results

Analysis of data regarding patient satisfaction at 12 months revealed that there were significant increase in satisfaction to PEEK compared to PMMA sides in all items included in questionnaire: Color ,Shape ,feasibility to use brush , ability to eat and overall satisfaction .

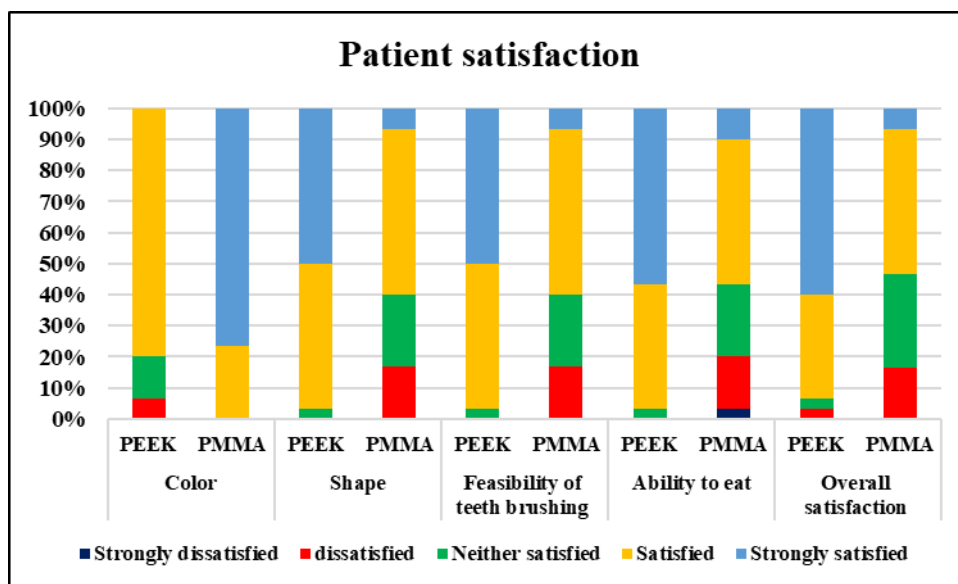


Figure (2): Assessment of patient satisfaction for both space maintainer for one year follow up period

Discussion

Despite efforts and advancements in the restoration of decaying primary teeth, early loss of primary teeth is a prevalent problem that, if not appropriately treated, can have negative consequences for arch integrity and permanent dentation alignment. [9]. In certain instances, immediate space maintainer creation is thought to be the best therapy option for preventing the negative effects of primary early teeth loss [10].

Although band and loop conventional space maintainer is the most widely used fixed type in cases of single tooth loss, it has a failure rate ranging from 13% to 63%, with drawbacks such as non-functioning and poor aesthetics. [11]. The utilization of a CAD/CAM space maintainer has been suggested as a superior option to a standard one in terms of aesthetics. [12].

Some publications have stated that PEEK and PMMA have been tested as appropriate materials for the construction of CAD/CAM bridges. [13,14]. Because there is no published clinical research comparing the clinical efficacy of PMMA and PEEK materials when used as space maintainers, the current study was conducted for this reason with a randomized controlled design to compare between them.

The current investigation used a split mouth randomized controlled trial design, which has the following advantages: high evidence level, eliminates inter-subject variability, reduces costs, has a greater ethical acceptability because patients benefit from both treatments and a lower sample size is required. [15].

The current study followed strict uniformity by adopting similar procedures for both materials in terms of tooth preparation and cementation, all of which were completed by the same operator [15, 16].

The selected children age was ranged from 4 to 7 years as they did not have all their mandibular permanent incisors erupted and the first permanent molars had not yet fully erupted and hence could not be banded for lingual arch construction [17]. To overcome the reported statistically significant greater survival rate for SMS cemented on the left side of the oral cavity compared to those cemented on the right side, PEEK SM was randomly assigned to one side and PMMA SM to the other. [18].

Assessment of patient satisfaction towards PEEK and PMMA SMs was executed using Likert-type scale. It is a simple tool with adequate reliability and validity [19,20].

The results of the current study revealed that there were significant increase in satisfaction to PEEK compared to PMMA sides in all items included in questionnaire: Color, Shape, feasibility to use brush, ability to eat and overall satisfaction. Thus, may be due to the higher strength, fatigue resistance, hardness, wear resistance and color stability for PEEK versus PMMA [21,22].

The significant increase in patient satisfaction regarding color of PEEK after one year follow up period although the pleasing initial color of PMMA could be attributed to low color stability of PMMA in comparison to PEEK material [21]. There were no published clinical trials that allowed comparison of the tested materials as CAD/CAM space maintainer constructing materials, hence the current study results could not be compared to earlier studies.

Conclusion

PEEK and PMMA CAD/CAM space maintainers represent esthetic alternatives to conventional space maintainer with superior patient satisfaction for PEEK space maintainer.

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