

# A New Criteria to Assess Quality of Obturation in Primary Teeth: KEDOO Classification

Ganesh Jeevanandan<sup>1</sup>, Lavanya Govindaraju<sup>2</sup>, Niharika Kotian<sup>3</sup>, Prabhadevi C Maganur<sup>4</sup>, Nikhil Marwah<sup>5</sup>, Satish Vishwanathaiah<sup>6</sup>

## ABSTRACT

**Aim:** The success of the pulpectomy depends on adequate access, cleaning, shaping, and good-quality obturation. Evaluating the quality of obturation is the major tool that determines the success of the procedure. The present study aimed to assess the quality of obturation in all the canals of primary teeth and suggest a new classification.

**Materials and methods:** A total of 1,000 radiographs of the pulpectomy procedure performed in primary molars were evaluated. The quality of obturation was assessed for each canal using the criteria given by Coll and Sandrian. The prevalence of each obturation criterion in every canal was represented in the form of a percentage.

**Results:** It was observed that among the mandibular primary molars, most of the mesial canals were underfilled, and in the distal canal, most of the canals were overfilled. Among the maxillary primary molars, most of the mesial canals were overfilled, more distal canals were underfilled, and with respect to palatal canals, optimal obturation was seen.

**Conclusion:** The pitfalls of the previous classification were revised, and a new classification for assessing the quality of obturation was proposed, which is arch, segment, and canal specific.

**Clinical significance:** The new classification will give a more precise assessment for the evaluation of various techniques and materials used for pulpectomy in primary teeth.

**Keywords:** Classification, Obturation, Primary teeth, Pulpectomy.

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## INTRODUCTION

Preservation of the primary tooth in its healthy state should be the goal of every pediatric dentist. Primary teeth are considered the best space maintainers hence should be retained for a longer duration to maintain their functions.<sup>1</sup> Primary teeth also play a vital role in the eruption of permanent teeth and the development of the jaws. It also plays a crucial role in the general health of pediatric patients. Dental caries and trauma to primary teeth might lead to pulpal inflammation causing pain, and requires intervention.<sup>2</sup> Pulpectomy is one of the preferred treatment modalities indicated in teeth with pulpal necrosis, chronic pulpitis, and accidental exposure of the pulp.<sup>3</sup> It is a more conservative approach to prevent the premature loss of primary teeth. Pulpectomy aims at reducing the bacterial count and promoting healing of the periradicular tissues.<sup>4</sup> Pulpectomy is advantageous as it retains the primary molars to act as a functional component in the dental arch for many years.<sup>5</sup> Pulpectomy, as compared to extraction, is a more reasonable treatment approach as it ensures normal exfoliation of the primary teeth and aids in the eruption of the successor permanent teeth.<sup>6</sup>

The success of the pulpectomy depends on adequate access, cleaning and shaping and good quality obturation. Evaluating the quality of obturation is the major tool that exists to determine the success of any new instrument, material or technique used for pulpectomy in primary teeth. There is only one criterion that exists to determine the quality of obturation in primary teeth, and it is the gold standard proposed by Coll and Sadrian in 1996, according to which underfilling means all the canals were

<sup>1-3</sup>Department of Pedodontics, Saveetha Dental College & Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS) (Deemed to be University), Chennai, Tamil Nadu, India

<sup>4,6</sup>Department of Preventive Dental Sciences, Division of Pedodontics, College of Dentistry, Jazan, Saudi Arabia

<sup>5</sup>Department of Pedodontics and Preventive Dentistry, Mahatma Gandhi Dental College and Hospital, Jaipur, Rajasthan, India

**Corresponding Authors:** Ganesh Jeevanandan, Department of Pedodontics, Saveetha Dental College & Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS) (Deemed to be University), Chennai, Tamil Nadu, India, e-mail: helloganz@gmail.com; Satish Vishwanathaiah, Department of Preventive Dental Sciences, Division of Pedodontics, College of Dentistry, Jazan, Saudi Arabia, e-mail: drvsatish77@gmail.com

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filled >2 mm short of apex, optimal filling one or more of the canals having obturating material ending at the radiographic apex or upto 2 mm short of the apex, and overfilling means if any canal showing obturated material extending beyond the radiographic apex.<sup>7</sup>

The existing criteria do not have a prototype to detect the presence of voids. The presence of voids in obturated root canals

**Table 1:** The table describes the quality of obturation in canals in both maxillary and mandibular primary molars

Mandibular canals	
Mesial canals	
Optimally filled	24.5%
Overfilled	31.5%
Underfilled	44%
Distal canals	
Optimally filled	33%
Overfilled	41%
Underfilled	26%
Maxillary canals	
Mesial canals	
Optimally filled	34%
Overfilled	48%
Underfilled	18%
Distal canals	
Optimally filled	25%
Overfilled	30%
Underfilled	45%
Palatal canals	
Optimally filled	55%
Overfilled	35%
Underfilled	10%

minimizes the survival rate of the tooth. Also, in the existing criteria, the judgment of underfill vs optimal fill is perplexing as in a multi-rooted tooth, if one canal is optimally filled and the other canals are way short of the apex, it is still categorized as optimal fill, which needs to be revised. A canal-specific classification must be proposed to solve the limitation of the existing classification. Also, a distinct classification for anterior and posterior primary teeth as well as maxillary and mandibular primary teeth, needs to be emphasized. Hence the present study aimed to assess the quality of obturation in all the canals of primary teeth and suggest a new classification for the same overcoming the limitations of the existing classification.

## MATERIALS AND METHODS

The present observational study was done to introduce a new criterion to assess the quality of obturation in primary teeth. The study did not actively engage with the participants, and data records of the patients were obtained. Ethical clearance was obtained from the Institutional Review Board (SRB/SDC/PEDO-1980/20/05). All the records were blinded, and consent to access the records was obtained from the university.

Data were collected from children who visited the university dental clinic. A total of 1,000 radiographs of pulpectomy procedures performed in primary molars were evaluated. The radiographs were examined in a standardized environment by the examiners. The evaluation was done separately for maxillary and mandibular teeth based on their canals. The quality of obturation was assessed for each canal using the criteria given by Coll and Sandrian.<sup>7</sup> The material used for the pulpectomy procedures was metapex. All the data was transferred to a spreadsheet where the prevalence of each obturation criterion in every canal was represented in the form of percentage. There were two

reviewers involved in the study. Validation of the data was done by both reviewers.

## RESULTS

Among the 1,000 primary molars, 500 were mandibular primary molars, and 500 were primary maxillary molars. The quality of obturation in canals in both maxillary and mandibular molars is described in Table 1.

## DISCUSSION

Management of infected primary teeth not only involves debridement of the root canal and filling the root canal with an obturating material that is biocompatible and would resorb at the same rate as the root of the concerned tooth.<sup>8</sup> It is essential to have a better quality of obturation as it minimizes the risk of apical percolation and coronal leakage.<sup>9</sup> Quality of obturation plays an important role in primary teeth as it is not easy to thoroughly debride microbes from the numerous accessory canals present in the root canal of primary teeth.<sup>10-13</sup> The ultimate goal of any obturating material is to adapt to the walls of the canals and fill the root throughout its length without overfilling.<sup>14</sup> Quality of obturation can be evaluated using radiographs, dye, radioisotopes, and clearing techniques following tooth sectioning.<sup>15</sup>

In literature, there are numerous studies that evaluate the quality of obturation by using different materials and techniques, but the criteria to assess the quality of obturation has been constant. In the present study, the purpose was to derive a new criterion from classifying the quality of obturation inspired by the classification given by Coll and Sandrian in 1996.<sup>7</sup>

High-quality radiographs are imperative to assess all the stages of treatment, right from the initial diagnosis to the follow-up of the treatment. Diverse imaging systems such as digital radiography, analog radiography and cone beam computed tomography (CBCT) are available to assess the quality of obturation in primary teeth. In a study done by Matherne et al.,<sup>16</sup> it was concluded that digital radiography is preferred due to low patient exposure, magnification of images not required for better assessment and rapid access to images. It was also reported that digital radiography is more effective for the detection of voids that are small in size as compared to CBCT and analog radiography.<sup>17</sup> Hence in the present study, we used digital radiography to assess the quality of obturation as it is minimally invasive and is the most commonly used radiographic technique in practice.

From the data collected, it is observed that 57.5% of the obturation in primary mandibular molars was categorized as optimal fill, but when the canals were assessed individually, it was found that only 24.5% of the mesial canals and 33% of the distal canals were optimally filled whereas the other canals should have been underfilled. According to Coll and Sandrian's<sup>7</sup> criteria, even if one canal is obturated very much short of the apex and the other canal is optimally filled, it is still considered as optimal fill, which according to the authors of the present study, feel needs a major revision. Similar results were seen with maxillary teeth as well. Assessing the canals individually will be more appropriate, and hence the authors in the present study proposed a classification that was more canal specific. The judgment of underfill vs overfill in the existing criteria is perplexing, and also it does not include the presence of voids.

Digital radiography is a two-dimensional image, and separately assessing the mesiolingual and mesiobuccal canals will be

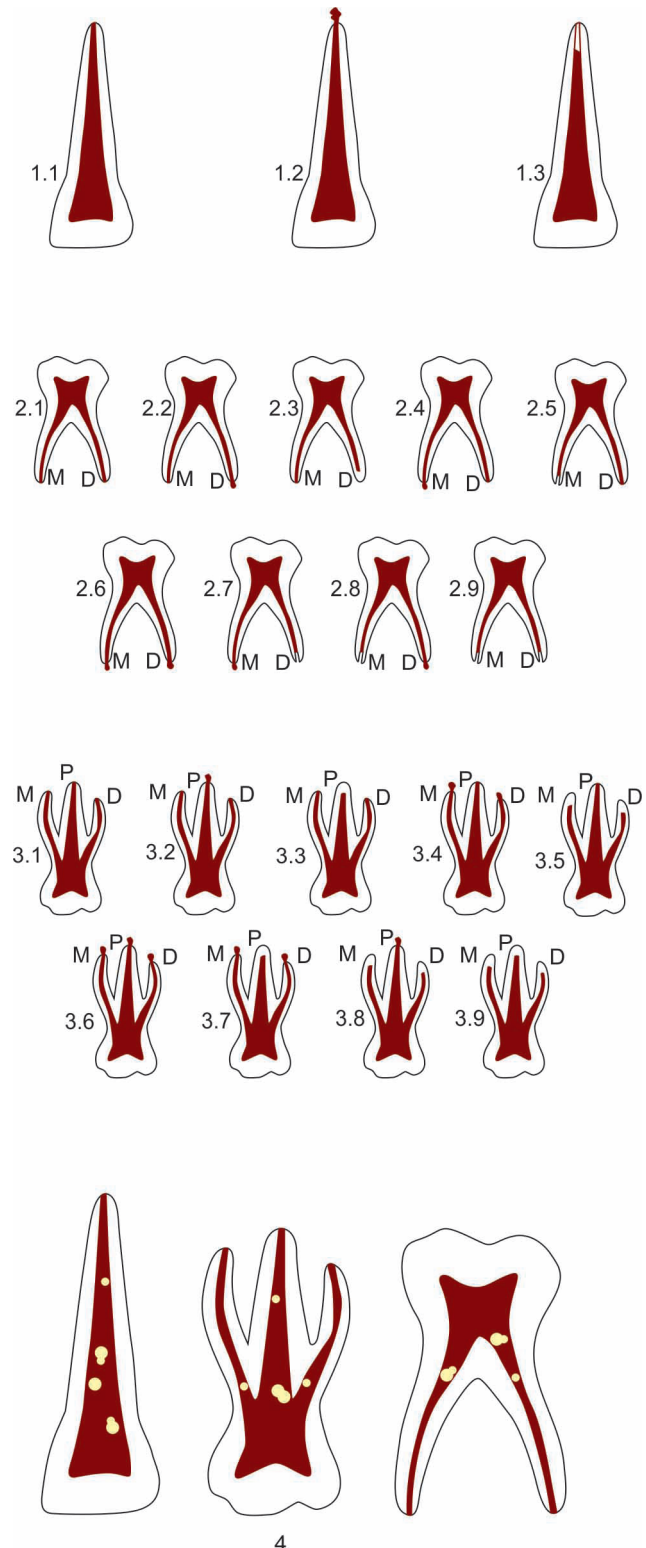
challenging; hence for convenience purposes and ease of use, the mandibular molar canals were divided into mesial and distal only, and in maxillary molars, it was divided into mesial, distal, and palatal. An additional criterion was also put forward by the authors wherein the presence of voids was assessed in the canals. Voids in both coronal as well as apical portions of the root canal may lead to leakage. This leads to high chances of reinfection.<sup>18</sup> Assessment of voids can be done using radiographs, but it is difficult to find the exact location and number of voids. In an *in vitro* study done by Dandashi et al., voids were assessed with the help of anterior-posterior and lateral radiographs.<sup>19</sup>

In the present study, if the obturation material is at the apex or 2 mm short of the apex, it was considered an optimal fill. If

the obturation material was greater than 2 mm from the apex, it was categorized as underfill, and if it was extruded beyond the apex, it was categorized as overfill. The authors proposed four categories in their classification where the first category assessed obturation in primary anterior teeth, the second category assessed obturation in posterior mandibular teeth, the

**Table 2:** KEDOO classification proposed by the authors for assessing quality of obturation in posterior teeth

KEDOO class 1	Assessment of primary anterior teeth 1.1: Optimal fill 1.2: Overfill 1.3: Underfill
KEDOO class 2	Assessment of primary posterior mandibular teeth 2.1: Mesial—optimal Distal—optimal 2.2: Mesial—optimal Distal—over 2.3: Mesial—optimal Distal—under 2.4: Mesial—over Distal—optimal 2.5: Mesial—under Distal—optimal 2.6: Mesial—over Distal—over 2.7: Mesial—over Distal—under 2.8: Mesial—under Distal—over 2.9: Mesial—under Distal—under
KEDOO class 3	Assessment of primary posterior maxillary teeth 3.1: Mesial and distal—optimal Palatal—optimal 3.2: Mesial and distal—optimal Palatal—over 3.3: Mesial and distal—optimal Palatal—under 3.4: Mesial and distal—over Palatal—optimal 3.5: Mesial and distal—under Palatal—optimal 3.6: Mesial and distal—over Palatal—over 3.7: Mesial and distal—over Palatal—under 3.8: Mesial and distal—under Palatal—over 3.9: Mesial and distal—under Palatal—under
KEDOO class 4	Presence of voids in any canal 4.1: Voids in canals of anterior tooth 4.2: Voids in canals of maxillary molars 4.3: Voids in canals of Mandibular molars



**Fig. 1:** Pictorial representation of KEDOO classification

**Table 3:** Criteria for assessment of obturation in each canal

Optimal fill	Obturation material is at or 2 mm short of apex
Underfill	>2 mm from the apex
Overfill	Extruded beyond the apex

third category assessed obturation in posterior maxillary teeth, and the fourth category assessed the presence of voids in the primary canals. The Kids Endodontic Obturation Quality (KEDOO) classification in detail is mentioned in Table 2. The diagrammatic representation of the same is illustrated in Figure 1.

In the present study, only the obturated primary molars were assessed. Assessment of the primary anterior was not done as they are single-rooted and have one canal; hence the preliminary classification of optimal fill, underfill, and overfill was adequate. Table 3 describes the criteria for assessment of obturation in each canal.

Further studies need to be conducted utilizing the newly derived KEDOO classification for assessing the quality of obturation in primary teeth to validate the proposed criteria.

## CONCLUSION

With the data collected, pitfalls of the previous classification were revised, and a new classification (KEDOO) for assessing the quality of obturation was proposed, which is arch, segment, and canal specific.

## AUTHORS CONTRIBUTION

GJ and SV conceived the ideas, NK and LG collected the data, GJ, NK, and LG analyzed the data, and GJ, NK, LG, PM, NM, and SV led the writing.

## ORCID

Ganesh Jeevanandan <https://orcid.org/0000-0003-3631-6982>  
 Prabhadevi C Maganur <https://orcid.org/0000-0002-0959-2597>  
 Satish Vishwanathaiah <https://orcid.org/0000-0002-8376-297X>

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