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PREDICTION OF STAINLESS-STEEL CROWN SIZE IN PRIMARY MOLARS USING DIGITAL RADIOGRAPHIC METHOD

Paediatric Dentistry

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ABSTRACT

Aim: The aim of this study was to evaluate whether preoperative radiographic measurements could predict the final stainless-steel crown (SSC) size for restoration of primary molars. **Methodology:** A size fitting guide for selection of stainless-steel crowns has been developed by Colleen Helder et al., in an attempt to offer an additional method for crown selection. Using this guide the present study was conducted in children aged between 6-12 years who require stainless steel crowns. Pre operative radiographs were used to obtain two linear radiographic measurements (coronal & cervical). The measurements obtained were later compared with the size fitting guide and the first crown size for try on phase is selected. **Results:** Maxillary coronal measurements and cervical measurements yielded a success rate of 92.3 percent, 84.6 percent respectively. However, in mandibular molars coronal measurements showed a success rate of 80 percent and cervical measurements 73.3 percent. **Conclusion:** The crown fitting guide has provided favorable clinical results in the present study. This technique will be useful for clinicians, especially novice dentists, in selecting first crown sizes during try on phase.

KEYWORDS

Ssc Size, Size Fitting Guide, Try In Crowns

INTRODUCTION

Most versatile and extremely common restorative therapy among pediatric patients is the use of stainless-steel crowns (SSCs). SSCs have many indications, some of which include extensive caries, cervical decalcification, developmental defects, and when failure of other materials is likely[1] Prefabricated SSCs provide a practical and affordable full coverage option for both clinicians and patients.

This non-custom option does, however, present sizing challenges in obtaining the best fit, sometimes requiring multiple size trials. Size selection is usually based on trial-and-error method. If a single tooth requires multiple crowns to obtain the "best fit," the trial phase can increase procedural time, decreasing efficiency, increase waste. Hence alternative methods have been explored.

There is also a strong propensity for utilization of these crowns among high caries-risk children as a more definitive treatment option.[1]

Size selection is based on trial and error, with the goal of fitting the smallest crown that can be seated that also reproduces pretreatment proximal contacts.[2]

Crown size estimation can also be supplemented by measuring the pretreatment mesial-distal molar length[3,4] and then choosing the crown that most closely matches; however, this requires additional instrumentation, such as a periodontal probe or Boley gauge. Overall, one might assume that experience lends to proficiency with visual size estimation.

The utilization of pretreatment radiographs offers a possible modality for indirect crown size estimation. If found to have applicability, this modality could prove advantageous for novice practitioners in estimating initial crown selection. This would provide a pretreatment starting point for trial-and-error fitting before the patient presents for an appointment. This has the potential in some cases to increase efficiency and decrease crown waste. Radiographic measuring is not a novel dental methodology, as it is commonly used in disciplines such as endodontics[7] and implantology.[8] This is, however, a novel implementation as it has been applied to the fitting of steel crowns in primary molars.

The purpose of this study was to determine if a pretreatment radiographic measurement can predict the final stainless steel crown size utilized in a clinical setting offering an additional method for crown selection.

Inclusive criteria

- Children aged between 6-12 years
- Multi-surface carious lesions
- Extensive decay
- Tooth that requires pulp therapy
- Severe bruxism
- Hypoplastic teeth

Exclusive criteria

- Syndromes associated with dental anomalies
- Teeth with severe decay causing space loss
- Periapical pathology
- Nickel Chromium allergy

Methodology

Ethical approval was obtained from the Institutional Review Board. This study was conducted in subjects aged 6-12 years who received primary molar SSCs between April 1, 2022 and October 10, 2022. The written informed consent was obtained from parents of children who participated in the study.

The present study was conducted for evaluating stainless steel crown size selection prediction by digital radiographic primary molar measurements. A total of 28 children in the age group of 6 years to 10 years who required crowns were enrolled for the study. In total sample size 13 teeth were maxillary molars, and 15 were mandibular molars.

Intra oral periapical pre operative radiographs taken for diagnostic purpose only were used, to obtain two linear Radiographic measurements (coronal & cervical). At first, a coronal measurement, was obtained by drawing a digital line parallel to the occlusal plane of the quadrant above the respective tooth. From the most convex portion of the mesial contact to the most convex portion of the distal contact, this line was extended.

Later, cervical linear radiographic measurement was done. The

cervical measure is the length of the digital line extending from the mesial point of cemento-enamel junction to the most distal point of the cemento-enamel junction.

The measurements obtained were later compared with the size fitting guide (According to Colleen Helder et al., 2022)[5] and the first crown size for try on phase is selected. If the crown does not fit in the first try it is considered a failure and the clinician used next corresponding size until the desired fit is obtained. Primary molar SSCs (3M™ ESPE™, Maplewood, Minn., USA) used were pre trimmed, crimped and belled.

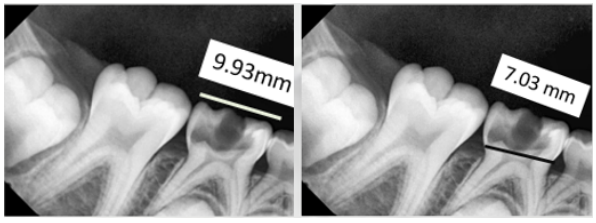


Figure 1: Showing coronal measurements
Figure 2: Showing cervical measurements

Statistical analysis

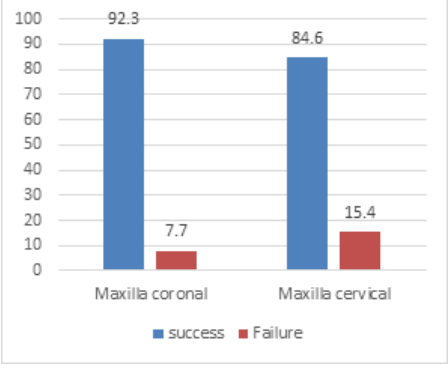
All the data obtained was subjected to statistical analysis using SPSS (Statistical Package for Social Sciences) version 21.0 software.

RESULTS

Maxillary coronal and cervical measurements yielded a success rate of 92.3% and 84.6% respectively i.e., the desired fit was achieved in the first try (Graph 1). However, in mandibular molars coronal measurements showed a success rate of 80% and cervical measurements showed a success rate of 73.3% (Graph 2).

Table 1: Radiographic coronal and cervical length measurements of maxillary primary molars.

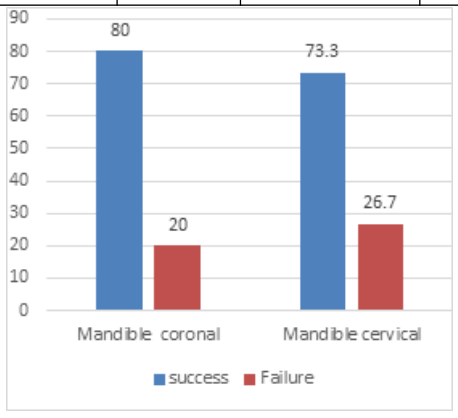
Maxillary coronal Measurements (in mm)	Interpretation (crown size)	Maxillary cervical Measurements (in mm)	Interpretation (crown size)
6.5	4	5.45	4
6.79	4	5.43	4
8.15	2	6.07	2
6.87	4	4.93	4
7.57	5	5.71	5
10.24	4	7.42	4
6.86	4	5.46	4
7.62	5	5.6	5
9.2	7	7.6	4
7.7	5	5.3	4
6.75	4	5.17	4
6.75	4	5.22	4
7.32	4	5.92	5



Graph 1: Represents success percentage in maxillary primary molars

Table 2: Radiographic coronal and cervical length measurements of mandibular primary molars.

Mandibular coronal Measurements (In mm)	Interpretation (Crown size)	Mandibular cervical Measurements (In mm)	Interpretation (Crown size)
11.37	6	9.48	6
10.78	5	8.41	5
9.68	4	7.80	4
9.84	4	8.23	5
8.01	4	6.99	4
10.21	4	8.00	4
10.7	5	6.7	5
12.10	7	10.3	7
10.07	4	8.08	4
7.88	4	6.77	4
10.55	4	8.27	4
8.26	5	7.05	5
10.14	4	7.44	3
10.75	5	8.61	5
10.91	7	9.00	7



Graph 2: Represents success percentage in mandibular primary molars

DISCUSSION

The most widely used restorative option for conserving and restoring the remaining tissue of severely decayed and damaged teeth are SSCs. They were first introduced by Engel in pediatric dentistry in the year 1947, which was later popularized in 1950 by Humphrey.

For over half a century, SSCs have shown to be more durable and long-lasting than other restorative materials such as made of composite materials or amalgam. [7-9]

They are more frequently used in patients who exhibit high caries risk and whose treatment is performed under general anesthesia or sedation.[11] In fact, no restorative material has provided the benefits of low cost, durability and reliability when interim full-coronal coverage is required. [7-9]

In a recent retrospective study SSCs were shown to have a higher survival rate when compared to multi surface restorations and could be considered when treating multi surface caries in children especially who are younger than four years old where possible retreatment can be avoided. [1]

In humans tooth size is determined by polygenic genetic factors. The environmental influences include particularly the ethnicity, socio-economic conditions, nutrition, maternal aspects such as gestational conditions, childhood health and systemic factors.[11] Data regarding tooth dimensions are available in abundance in the literature; however, only few studies have mentioned the role of application of tooth dimension in assisting initial SSC size selection.

This developed predictive model has a slight advantage over the current method of solely using trial-and-error fitting, as it is cost-effective, efficient in reducing time taken for the procedure. [4]

In the present study, Maxillary coronal measurements and cervical measurements yielded a success rate of 92.3 percent, 84.6 percent respectively with one fit. However, in mandibular molars coronal measurements showed a success rate of 80 percent and cervical measurements 73.3 percent with one fit.

With two fits success rate of 7.7 percent coronally and 15.4 percent cervically were seen in maxillary primary molars. In mandibular

primary molars, with two fits 20 percent coronally, cervically 26.7 percent success rate were seen.

The coronal system was stable, regardless of decay extent, and yielded the best results for crown sizing. However, it requires slightly more attention to detail with measuring, as the line needed should be parallel to the occlusal plane. The cervical system was marginally easier to measure; however, it did yield slightly less prediction success.

If a single tooth requires multiple crowns to obtain the "best fit," the trial phase can increase procedural time, decreasing efficiency. Trials involving multiple crowns also have the potential to increase waste.[4]

For indirect crown size estimation utilization of pretreatment radiographs offers a possible modality. If found to have applicability, this modality could prove advantageous for novice practitioners in estimating initial crown selection. This would provide a pretreatment starting point for trial-and-error fitting before the patient presents for an appointment. This has the potential in some cases to increase efficiency and decrease crown waste.[4]

Meanwhile, radiographic measurements were not intended to be synonymous with physical crown measurements due to the likelihood of magnification error.[5]

Crown size estimation can also be supplemented by measuring the pretreatment mesial-distal molar length on the cast or directly in oral cavity and then choosing the crown that most closely matches;[3] however, this requires additional instrumentation, such as a periodontal probe or Boley gauge.

Novice dentists, or those with limited experience with stainless steel crowns, might find this radiographic method to be particularly helpful, without the use of additional measuring tools such as periodontal probes and Boley gauges. This might also be helpful in operating room situations where multiple oral rehabilitation cases are utilizing a central crown stock.[4]

The size guide which was taken in the present study was developed by Colleen Helder et al., (2022) who evaluated whether preoperative digital radiographic measurements could predict the final Stainless steel crown selection size for restoration of primary molars. Based on the Coronal measurements the practitioner achieved a correct fit using one, two, or three attempts with accuracy rates of 46%, 47 %, and 7% respectively with a cumulative rate through two attempts of 93%. Based on the cervical model, the practitioner achieved accuracy rates of 38 %, 51%, 11% in one, two and three attempts respectively with a cumulative rate through two attempts of 89%. The data obtained was used to formulate size fitting guides. They concluded that crown fitting guide has favorable clinical potential to assist providers, especially novice dentists, in selecting crown sizes. [4]

Azmat Yaqoob et al (2022)., evaluated SSC size selection prediction by digital radiographic primary molar measurements, which is similar to the present study. The results showed that the predictors and all covariates were statistically significant. These models can be utilized to create size fitting guides and has favorable clinical potential in selecting crown sizes. [11]

This method used only single line as a predictor. The utilization of software that could create simultaneous, multilinear measurements may result in a more predictive potential. This model also only focuses on a single brand of crowns and a single digital radiographic software. Future studies could focus on other manufacturers.

This crown fitting guide has promising clinical potential in assisting clinicians for selecting crown sizes, showing potential for extended radiographic application in dentistry, specifically technical efficiency, for education, and minimizing wastage of crowns.[11]

CONCLUSIONS

The crown fitting guide has provided favorable clinical results in the present study. This technique will be useful for clinicians, especially novice dentists, in selecting first crown sizes during try on phase. Though, it is not meant to supersede clinical judgment.

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