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Short Communication

Comparison between the average dimensions of three brands of stainless-steel crowns (SSCs) and the average dimensions of primary molar teeth

Maryam Sharifi[1], Mahsa Sayadizadeh[1], Narges Parizad[2], Nima Hatami[3], Hamidreza Poureslami[4*]

[1]Department of Pediatric Dentistry, Dental Faculty, Kerman University of Medical Sciences, Kerman, Iran
[2]Kerman Health Center, Kerman University of Medical Sciences, Kerman, Iran
[3]Department of Endodontics, Dental Faculty, Kerman University of Medical Sciences, Kerman, Iran
[4]Department of Pediatric Dentistry, Dental Faculty, Kerman University of Medical Sciences, Kerman, Iran

*Corresponding Author: Hamidreza Poureslami, Email: hamid42pour@yahoo.com

Abstract

Background: Stainless-steel crowns (SSCs) are usually used for deciduous teeth with more than two destroyed surfaces. Selecting the suitable SSC, in terms of proximal fit and marginal fit, has usually been challenging for practitioners. The current study compares the deciduous molar dimensions in the SCCs with the dimensions of these teeth given in the textbook.

Methods: The dimensions of 3M, Kids Crowns, and KTR SCCs were measured using a digital caliper. Utilizing SPSS 26 software, the data was examined and compared to the table of standard sizes of primary teeth using one-sample *t* test, ANOVA, and Tukey's test. *P* values less than 0.05 were considered significant.

Results: The study showed no significant difference in upper first molar SSCs in the occlusal-cervical dimension in Kids Crowns ($P=0.14$) and 3M ($P=0.078$) and in the mesiodistal dimension in Kids KTR ($P=0.083$) and Crowns ($P=0.22$). There was no significant difference in lower first molar SSCs in the occlusal-cervical dimension in Kids Crowns ($P=0.14$) and in the bucco-lingual dimension in 3M ($P=0.91$) and KTR SSCs ($P=0.09$). There was no significant difference in the upper second molar SSCs in the occlusal-cervical dimension of Kids Crowns ($P=0.28$) and 3M ($P=0.32$). There was no significant difference in lower second molar SSCs in the occlusal-cervical dimension in Kids Crowns ($P=0.27$) and KTR ($P=0.07$), in the mesiodistal dimension in Kids Crowns ($P=0.22$), KTR ($P=0.22$), 3M ($P=0.59$) and in the bucco-lingual dimension of KTR ($P=0.26$) and 3M ($P=0.78$).

Conclusion: SSCs and teeth had the highest conformity in the occlusal-cervical dimension and the lowest conformity in the mesiodistal and bucco-lingual dimensions. SSCs had the highest conformity with the lower molars.

Keywords: Primary teeth, Molar teeth, Stainless steel crown

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Introduction

Dental caries is common among children, and in the presence of numerous caries risk factors, primary molars can decay and become severely damaged.[1-3] Sometimes the extent and severity of damage caused by crown fractures make it difficult to restore and rebuild the teeth.[4,5] In these cases, and specifically, if the choice treatment is pulp therapy, the most popular and most common method to preserve crown of the teeth is to use stainless steel crowns.[6-9] Placement of Stainless-steel crowns (SSCs) has a lower risk of treatment failure or long-term pain compared to dental fillings.[6]

SSCs are manufactured by different companies and differ in size, shape, and contour.[9,10] In terms of morphology, the cervical one-third of a primary tooth is noticeably different from that of a permanent successor, being the most convex.[11] Choosing the proper SSC, in terms of proximal fit and marginal fit, has usually been challenging for dentists, especially pediatric dentists.[12] The most common challenges reported by dentists who use SSCs are problems with SSC adjustment and subsequent aesthetic issues.[13]

Although there are some studies on the size of SSCs, this study examines their dimensions for all primary molars in the maxilla and mandible and compares three brands of SSCs available in Iran, with the commercial names 3M, KTR, and Kids Crowns, and compares their mean dimensions with the mean dimensions of primary molars in a reference table.

Methods

In this descriptive-analytical study, labiolingual as well as

mesiodistal dimensions in both the cervical and occlusal area and the occlusal-cervical height of SSCs for the molar teeth in both the maxilla and mandible, ranging from size 2 to 7, were measured. These measurements were taken from three brands of SSC kits, including 3M (made in the USA), Kids Crowns (made in South Korea), and KTR (made in Japan). The evaluated crowns totaled 144 SSCs. The measurement of SSC dimensions in the pediatric ward of Kerman Dental School was performed under the direct supervision of two authors of the article. To increase the accuracy of measurements for each size of SSC, one SSC was identified in each kit, and the measurements were performed only on that SSC. The occlusal area's mesiodistal dimension was determined by measuring from the midpoint of the mesial marginal ridge to the midpoint of the distal marginal ridge. The measurements for the mesiodistal dimension of the cervical area were made 1 mm above the cervical margin of the SSC in the mesial and distal areas. The measurements for the buccolingual dimension of the occlusal area were made on the distance between the distal and mesial margins of each SSC from the midpoint. The measurements for the buccolingual dimension of the cervical area were made 1 mm above the cervical margin in the buccal and lingual area. The measurements for occlusal-cervical height were made from the top of the tallest cusp in the buccal surface to the cervical margin.[14,15] The measurements for the three SSC brands were performed by a digital caliper (Zonaris, Poland) with an accuracy of 0.1 mm. First, each size was compared separately with the reference table from *Wheeler's Textbook on Dental Anatomy and Physiology*[16] (Table 1), and then the measured dimensions were compared with the mean dimensions mentioned in the table for the primary molar teeth. The obtained measurements were coded and then the data were entered into SPSS 26 software. The distribution of all of the measured dimensions was examined using the Kolmogorov-Smirnov test. In the statistical results, descriptive statistics methods were used (mean and standard deviation). For each SSC brand, all dimensions were first compared with the sizes mentioned in the reference book using the one-sample t-test and presented in four tables. The P value was considered less than 0.05 ($P<0.05$).

Results

According to Table 2, The differences with standard values were not significant only in the following: Kids Crowns and 3M SSCs ($P=0.14$ and $P=0.078$, respectively) in occlusal-cervical height and Kids Crowns and KTR SSCs ($P=0.22$ and $P=0.083$, respectively) in mesiodistal dimension on the occlusal surface. According to Table 3, the differences with standard values were not significant only in the following: Kids Crowns ($P=0.14$) in occlusal-cervical height, 3M and KTR SSCs ($P=0.91$ and $P=0.09$, respectively) in the buccolingual dimension on the occlusal surface, and KTR SSC ($P=0.75$) in the mesiodistal dimension on the occlusal surface. Based on Table 4, The difference between Kids Crowns and 3M SSCs and the standard values was not significant ($P=0.28$ and $P=0.32$, respectively) only in occlusal-cervical height. Based on Table 5 in the lower second primary molar, the difference with the standard values was not significant in the following: Kids Crowns and KTR SSCs ($P=0.27$ and $P=0.07$, respectively) in the occlusal-cervical height, Kids Crowns, 3M, and KTR SSCs ($P=0.22$, $P=0.59$, and $P=0.22$, respectively) in the mesiodistal dimension on the occlusal surface, and 3M and KTR SSCs ($P=0.78$ and $P=0.26$, respectively) in the buccolingual dimension.

Discussion

The objective of this study was to assess the average dimensions of SSCs utilized in Iran for primary molars and compare them to the dimensions provided in the reference book.[16] In Afshar et al study, first and second primary molar measurements were collected from both jaws and their mesiodistal and buccolingual dimensions were compared with 3M SSCs. Their research showed that in mesiodistal dimensions, the best conformity was observed in the lower second primary molar teeth and the worst conformity was observed in the upper first

Table 1. Standard sizes of primary teeth from *Wheeler's Textbook on Dental Anatomy and Physiology* (16)

The tooth	Length overall	Length of crown	Length of root	Mesiodistal diameter of the crown	Mesiodistal diameter of the crown at the cervix	Labiolingual diameter of the crown	Labiolingual diameter of the crown at the cervix
Upper central incisor	16.0	6.0	10.0	6.5	4.5	5.0	4.0
Upper lateral incisor	15.8	5.6	11.4	5.1	3.7	4.0	3.7
Upper canine	19.0	6.5	13.5	7.0	5.1	7.0	5.5
Upper first molar	15.2	5.1	10.0	7.3	5.2	8.5	6.9
Upper second molar	17.5	5.7	11.7	8.2	6.4	10.0	8.3
Lower central incisor	14.0	5.0	9.0	4.2	3.0	4.0	3.5
Lower lateral incisor	15.0	5.2	10.0	4.1	3.0	4.0	3.5
Lower canine	17.5	6.0	11.5	5.0	3.7	4.8	4.0
Lower first molar	15.8	6.0	9.8	7.7	6.5	7.0	5.3
Lower second molar	18.8	5.5	11.3	9.9	7.2	8.7	6.4

Table 2. The comparison of the upper first primary molar dimensions in three brands of SSCs (in mm)

SSC	Number	Dimension	Mean	SD	Standard number	*P* value[a]
Kids Crowns	12	Occlusal-cervical dimension	5.38	0.61	5.10	0.14
		Mesiodistal dimension in the cervical area	7.83	0.67	5.20	0.0001
		Mesiodistal dimension on the occlusal surface	7.58	0.75	7.30	0.22
		Buccolingual dimension in the cervical area	8.20	0.53	6.90	0.0001
		Buccolingual dimension on the occlusal surface	6.73	0.72	8.50	0.0001
3M	12	Occlusal-cervical dimension	4.90	0.36	5.10	0.078
		Mesiodistal dimension in the cervical area	7.01	0.59	5.20	0.0001
		Mesiodistal dimension on the occlusal surface	6.86	0.59	7.30	0.025
		Buccolingual dimension in the cervical area	8.60	0.70	6.90	0.0001
		Buccolingual dimension on the occlusal surface	6.97	0.75	8.50	0.0001
KTR	12	Occlusal-cervical dimension	5.50	0.40	5.10	0.006
		Mesiodistal dimension in the cervical area	7.60	0.66	5.20	0.0001
		Mesiodistal dimension on the occlusal surface	7.64	0.62	7.30	0.083
		Buccolingual dimension in the cervical area	7.92	0.64	6.90	0.0001
		Buccolingual dimension on the occlusal surface	6.67	0.62	8.50	0.0001

Abbreviations: SSC, stainless-steel crowns; SD, Standard deviation.
[a] One-sample t-test
Note: The three SSC brands were significantly different from the standard table in some of the dimensions in the upper first primary molar ($P<0.05$).

Table 3. The comparison of lower first primary molar dimensions in three brands of SSCs (in mm)

SSC	Number	Dimension	Mean	SD	Standard number	*P* value[a]
Kids Crowns	12	Occlusal-cervical dimension	5.83	0.61	6.00	0.14
		Mesiodistal dimension in the cervical area	8.17	0.57	6.50	0.0001
		Mesiodistal dimension on the occlusal surface	8.15	0.61	7.70	0.026
		Buccolingual dimension in the cervical area	6.69	0.49	5.30	0.0001
		Buccolingual dimension on the occlusal surface	6.42	0.55	7.00	0.004
3M	12	Occlusal-cervical dimension	4.90	0.36	6.00	0.0001
		Mesiodistal dimension in the cervical area	7.01	0.59	6.50	0.007
		Mesiodistal dimension on the occlusal surface	6.86	0.59	7.70	0.0001
		Buccolingual dimension in the cervical area	8.60	0.70	5.30	0.0001
		Buccolingual dimension on the occlusal surface	6.97	0.75	7.00	0.91
KTR	12	Occlusal-cervical dimension	5.50	0.40	6.00	0.001
		Mesiodistal dimension in the cervical area	7.60	0.66	6.50	0.0001
		Mesiodistal dimension on the occlusal surface	7.64	0.62	7.70	0.75
		Buccolingual dimension in the cervical area	7.92	0.64	5.30	0.0001
		Buccolingual dimension on the occlusal surface	6.67	0.62	7.00	0.09

Abbreviations: SSC, stainless-steel crowns; SD, Standard deviation.
[a] One-sample t-test
Note: All three SSC brands showed significant differences with the standard table in some of the dimensions in the lower first primary molar ($P<0.05$).

and second primary molar teeth.[14] Based on the present study, the minimum differences between the mesiodistal dimension on the occlusal surface of 3M SSCs and the standard table were for the lower second molar, upper first molar, lower first molar, and upper second molar, respectively, and the minimum differences between the buccolingual dimension in cervical area of the 3M crowns and the standard table were for upper first and second molar, lower first and second molar, respectively.

Afshar et al also evaluated Kids Crowns SSCs for the upper first molar. A comparison of both 3M and Kids Crowns brands with upper first molars showed a significant difference with the tooth measurements, although this difference was smaller in the Kids Crowns brand. Therefore, they concluded that the latter is better suited for the upper first molar than 3M in mesiodistal and buccolingual dimensions and suggested that as Kids Crowns requires less manipulation, this crown is recommended instead of 3M for the upper first molar.[14] Their results were similar to the present study results:

Table 4. The comparison of upper second primary molar dimensions in three brands of SSCs (in mm)

SSC	Number	Dimension	Mean	SD	Standard number	*P* value[a]
Kids Crowns	12	Occlusal-cervical dimension	5.87	0.51	5.70	0.28
		Mesiodistal dimension in the cervical area	9.81	0.52	6.40	0.0001
		Mesiodistal dimension on the occlusal surface	10.42	0.80	8.20	0.0001
		Buccolingual dimension in the cervical area	11.00	0.67	8.30	0.0001
		Buccolingual dimension on the occlusal surface	8.95	0.60	10.00	0.0001
3M	12	Occlusal-cervical dimension	5.87	0.55	5.70	0.32
		Mesiodistal dimension in the cervical area	9.73	0.60	6.40	0.0001
		Mesiodistal dimension on the occlusal surface	10.02	0.72	8.20	0.0001
		Buccolingual dimension in the cervical area	11.02	0.78	8.30	0.0001
		Buccolingual dimension on the occlusal surface	8.77	0.88	10.00	0.0001
KTR	12	Occlusal-cervical dimension	5.72	0.38	5.70	0.02
		Mesiodistal dimension in the cervical area	10.23	0.65	6.40	0.0001
		Mesiodistal dimension on the occlusal surface	10.17	0.70	8.20	0.0001
		Buccolingual dimension in the cervical area	9.74	0.75	8.30	0.0001
		Buccolingual dimension on the occlusal surface	8.49	0.60	10.00	0.0001

Abbreviations: SSC, stainless-steel crowns; SD, Standard deviation.
[a] One-sample t-test
All three SSC brands showed significant differences with the standard table in some of the dimensions in the upper second primary molar ($P<0.05$).

Table 5. The comparison of lower second primary molar dimensions in three brands of SSCs (in mm)

SSC	Number	Dimension	Mean	SD	Standard number	*P* value[a]
Kids Crowns	12	Occlusal-cervical dimension	5.67	0.53	5.50	0.27
		Mesiodistal dimension in the cervical area	10.28	0.77	7.20	0.0001
		Mesiodistal dimension on the occlusal surface	10.17	0.72	9.90	0.22
		Buccolingual dimension in the cervical area	9.55	0.67	6.40	0.0001
		Buccolingual dimension on the occlusal surface	8.20	0.64	8.70	0.02
3M	12	Occlusal-cervical dimension	5.87	0.55	5.50	0.04
		Mesiodistal dimension in the cervical area	9.73	0.60	7.20	0.0001
		Mesiodistal dimension on the occlusal surface	10.02	0.72	9.90	0.59
		Buccolingual dimension in the cervical area	11.02	0.78	6.40	0.0001
		Buccolingual dimension on the occlusal surface	8.77	0.88	8.70	0.78
KTR	12	Occlusal-cervical dimension	5.72	0.38	5.50	0.07
		Mesiodistal dimension in the cervical area	10.23	0.65	7.20	0.0001
		Mesiodistal dimension on the occlusal surface	10.17	0.70	9.90	0.22
		Buccolingual dimension in the cervical area	9.74	0.75	6.40	0.0001
		Buccolingual dimension on the occlusal surface	8.49	0.60	8.70	0.26

Abbreviations: SSC, stainless-steel crowns; SD, Standard deviation.
[a] One-sample t-test
All three SSC brands showed significant differences with the standard table in some of the dimensions in the lower second primary molar ($P<0.05$).

the difference with reference values in the dimensions of Kids Crowns (0.28 mm) in the mesiodistal dimension on the occlusal surface was smaller than those of 3M crowns (0.46 mm). In the buccolingual dimension in the cervical area, the difference between tooth dimensions and Kids Crowns (1.30 mm) was also smaller than the difference between tooth dimensions and 3M crowns (1.70 mm). In a study conducted at Tabriz University, Kids Crowns SSCs were found to be suitable for the upper right first molar too, but 3M SSCs were more suitable for the upper left first molar.[15] Another study was performed by Shahrabi et al on the first primary molars extracted from the mandible and 3M crowns. The results showed a significant difference in mesiodistal and buccolingual dimensions between the lower first molar teeth and the upper and lower crowns.[17] In the present study, by comparing the lower first molar tooth with 3M crowns, a significant difference was found in all dimensions, except in the buccolingual dimension on the occlusal surface. Considering that Shahrabi et al used a different measuring method, this difference seems to be reasonable.

A study by Al-Dulaimy and Al-khannaq compared the

mesiodistal dimensions of second primary molars from both jaws with 3M, Kids Crowns, and Rihany Crowns in Iraq. The mean dimensions of the second primary molar teeth in the mesiodistal dimension, both in the mandible and in the maxilla, were larger in boys than in girls.[18] In a study conducted by Barbería et al on the first and second primary molars of Spanish children, the mesiodistal, buccolingual, and occlusal-cervical dimensions of the crowns were measured, which showed that the mean dimensions of primary teeth in boys were larger than in girls.[19] The results of Al-Dulaimy and Al-khannaq's study showed that in the Kids Crowns brand, there was a significant difference for all sizes of dental crowns, except for size 2 of maxillary dental crowns for girls and size 5 of mandibular dental crowns for boys.[18] There was a difference in how the crowns were measured between this study and Al-Dulaimy and Al-khannaq's study, where three-dimensional scanning was used; this may explain the different results of the two studies. Also, in Al-Dulaimy and Al-khannaq's study, no significant difference was observed between the left and right sides of each tooth, except in the upper second molars of boys, which was 0.04 mm larger on the right side.[18] In another study, the dimensions of the first molar crowns of 3M and Kids Crowns brands were measured. According to the findings, 3M crowns were higher in all dimensions than Kids Crowns.[20] In the present study, maximum occlusal-cervical height was for the upper first molar in KTR, Kids Crowns, and 3M kits, respectively. For the lower first molar, this height was more in Kids Crowns, 3M, and KTR kits, respectively.

Strengths and Limitations

An effort was made to make the project a comprehensive study but not all brands of SSCs were assessed. Because they were not available.

Conclusion

Based on the results of this study, it is revealed that the dimensions of the SSCs and the standard values are most similar in the occlusal-cervical dimension. In the mandible, the largest dimensional differences were observed in the cervical area. In the maxilla, in addition to the cervical area, a large difference was observed in the occlusal surface of the upper second primary molar and the occlusal surface of the upper first primary molar; the measurements mentioned in the reference table were significantly smaller than the mean of the measured values. In other words, the dimensions of the teeth in the book reference table were generally smaller than the mean dimensions of sizes 2 to 7 of the crowns. Also, the crowns had the highest conformity with the lower first and second molar teeth and the lowest conformity with the upper second molar teeth.

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Authors' Contribution

Conceptualization: Hamidreza Poureslami.
Investigation: Narges Parizad, Maryam Sharifi, Mahsa Sayadizadeh.
Project administration: Hamidreza Poureslami, Maryam Sharifi.
Visualization: Nima Hatami, Maryam Sharifi, Mahsa Sayadizadeh.
Writing–original draft: Narges Parizad, Hamidreza Poureslami.
Writing–review & editing: Maryam Sharifi, Nima Hatami, Hamidreza Poureslami.

Competing Interests

The authors declare no conflict of interest.

Ethical Approval

The Ethics Committee of Kerman University of Medical Sciences approved current study (ethical code IR.KMU.REC.1400.542).

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