

Original Research

Changes in overbite after placement of stainless steel crowns with hall technique over a period of 1 year

¹Dr. Avneet Kaur, ²Dr. Bharat Suneja, ³Dr. Sunaina Jodhka, ⁴Dr. Jasvir Kaur, ⁵Dr. Anukirat Dev, ⁶Dr. Anchal Verma

¹PG Resident-Final Year, ² Professor and Head, ³ Professor, ⁴ Reader, ⁵ PG Resident, Department of Paediatric and Preventive Dentistry, BJS Dental College, Hospital and Research Institute, Ludhiana, Punjab, India;

⁶BDS, BJS Dental College, Hospital and Research Institute, Ludhiana, Punjab, India

ABSTRACT:

Background: Hall technique has been associated with a drawback of increase in overbite immediately after its placement, usually it settles down within a short period. Extensive research has not been done so far, regarding period of settlement of occlusion. **Objective:** So, the purpose of this paper was to evaluate the changes in overbite score at 2 weeks, 6 weeks, 6 months and after one year and how much time it takes to settle down to its original state. **Method:** 35 children aged 4-9 years fulfilling the inclusion criteria were given hall crown and overbite score was checked. Statistical Analysis was done using Independent Sample t-test and Tukey HSD post Hoc test. **Results:** Mean overbite score was closer to pretreatment values within 6 weeks but never settled down completely.

Received: 14 November, 2021

Accepted: 22 December, 2021

Corresponding author: Dr. Avneet Kaur, PG Resident-Final Year, Department of Paediatric and Preventive Dentistry, BJS Dental College, Hospital and Research Institute, Ludhiana, Punjab, India

This article may be cited as: Kaur A, Suneja B, Jodhka S, Kaur J, Dev A, Verma A. Changes in overbite after placement of stainless steel crowns with hall technique over a period of 1 year. Int J Res Health Allied Sci 2022; 8(1):72-77.

INTRODUCTION

With growing understanding of non-invasive caries management, biological approaches such as Hall technique have become popular for a paediatric patient. In 2006, Dr. Norna Hall, introduced Hall technique, in which crown is cemented without local anaesthesia, caries excavation or tooth preparation (1). The Hall Technique manipulates the plaque's environment by sealing it into the tooth, separating it from the substrates (essentially, nutrition) it would normally receive from the oral environment. However, there is good evidence that if caries is effectively sealed from the oral environment, the bacterial profile in the carious lesion changes significantly to a less cariogenic community, and the lesion does not progress (2)(9)(10)(11). Due to increased compliance, ease of treatment and effective management of deep carious lesions with excellent results, Hall technique is extensively used by pediatric dentists and is acceptable to the child patient and parents (2)(3)(4)(5).

However, a drawback associated with Hall crown is decrease in overbite seen immediately after placement. As the Hall technique does not involve any occlusal reduction of tooth, it is inevitable that placement of crown this way would result in premature contacts and decrease in overbite. Some studies have shown that during the follow up periods, there is re-establishment of even occlusal contacts within few weeks. Extensive research has not been done so far, regarding time period of settlement of occlusion (6)(7)(8).

So, the aim of this study was to evaluate the changes in overbite at various intervals i.e., at 2 weeks, at 6 weeks, 6 months and till the end of one year. Furthermore, the time period at which the occlusal settlement occurs was evaluated.

MATERIAL AND METHODS

Study was conducted in Department of Paediatric and Preventive Dentistry at Baba Jaswant Singh Dental College Hospital and Research Institute, Ludhiana in

children ages 4-9 years old. The sample size was calculated using formula:

Using Formula:

$$N = (Z \alpha/2)^2 2s^2/d^2$$

$$s = 0.46$$

$$Z \alpha/2 = Z_{0.05/2} = Z_{0.025} = 1.96 \text{ at type 1 error of 5\%}$$

$$d = 0.22$$

$$N = (1.96)^2 2 * 0.62^2 / 0.22^2 = 18.11$$

N denotes sample size, s is the standard deviation from previous study (6), d is precision and Z α/2 is level of significance. Sample size came out to be 18.11. Minimum of 19 children were required for the study. We included 35 children in our study, having 47 teeth on which Hall crown was delivered.

The protocol for the study was approved by Institutional ethics committee. Patients were recruited from November 2019 to October 2020. The procedure's possible risk/discomfort as well as possible benefits were fully explained to parents/guardians of the child involved. The parent/guardian's informed consent was obtained prior to the investigation.

Indications and Contra-Indications: as per stated by Innes et al., 2017 (8).

EXCLUSION CRITERIA

Absence or grossly decayed, either upper/lower canines on both sides.

Overbite score was checked before treatment, immediately after treatment, at 2 weeks, at 6 weeks, at 6 months and after 12 months. All teeth fulfilling the inclusion and exclusion in a patient, were treated in one sitting.

PROCEDURE TO CHECK OVERBITE

Before the start of procedure, the readings for checking the overbite at canine region were taken as described below,

1. The preliminary reading to check overbite at maximum intercuspation were taken during the first visit.
2. Each child was asked to bite down at maximum intercuspation. Then maxillary and mandibular canine of left side (if canines on left side were missing then readings were taken from right side) were dried with cotton pellet and a horizontal marking was done on the buccal surface of mandibular canine at the level of the intercuspation of maxillary canine tip, using a customized scale and an indelible pencil with Nib size 0.5mm. If any of the canines were missing from both sides, the subject was excluded from the study. (Figure 1, 2 & 3)
3. The vertical distance between marked line and the cusp tip of mandibular canine was measured using a probe with markings (Williams probe). (Figure 4)
4. Readings were recorded to the nearest to 0.5mm.
5. After taking the preliminary readings of overbite, separators were given on the selected tooth for treatment with the help of dental floss.
6. Second sitting was carried out after 3 days when adequate space was achieved between the tooth to be treated and adjacent teeth.
7. Stainless steel crowns (3 M) were checked according to the size of tooth. Most suitable crown was placed over tooth and checked for snap fit.
8. Crown was cemented with luting GIC. (Figure 5)
9. After the placement of hall crown, the overbite score was measured in a similar manner as done before the placement of crown. In case 2 or more crowns were indicated in same child overbite score was taken after placement of last crown. In case there was no vertical overlap, the reading was kept 0 and negative measurements were not taken. (Figure 6)
10. Similar readings were taken at interval of 2 weeks, 6 weeks, 6 months and 12 months.



Fig 1: Canine Relationship at Maximum Intercuspation Prior To Treatment for Measurement of Overbite

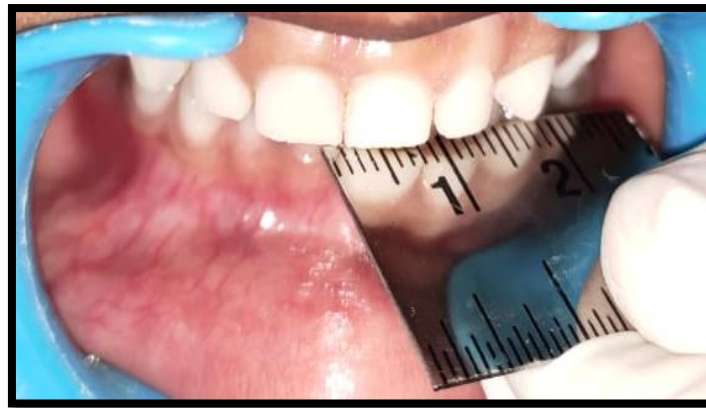


Fig 2: Placement of Customized Scale from Tip of Maxillary Canine to Mandibular Canine Measurement of Overbite



Fig 3: Markings Made with Indelible Pencil/Marker



Fig 4: Overbite Reading Before Crown Placement



Fig 5: Hall Crown Placement



Fig 6: Overbite Readings Taken Immediately After Placement of Crown

STATISTICAL ANALYSIS

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2019) and then exported to data editor page of SPSS version 22.0 (SPSS inc., Chicago, Illinois, USA).

Descriptive statistics including computation of percentages, means and standard deviations were calculated. The statistical tests applied for the analysis was independent sample t-test and Tukey HSD Post Hoc test. For all tests, confidence interval and p-value were set at 95% and ≤ 0.05 respectively.

RESULTS

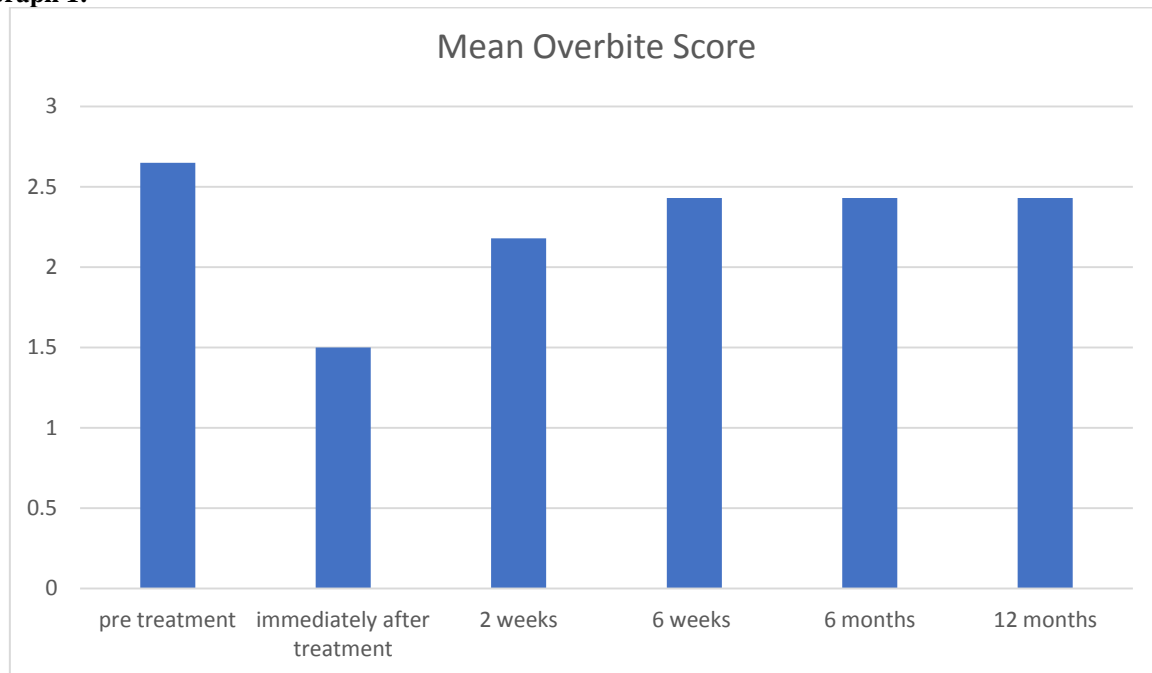
Evaluation on the bases of overbite score was done Before treatment, immediately after treatment, at 2 weeks, at 6 weeks, at 6 months and after 12 months.

On evaluating mean overbite scores and standard deviation at different intervals, values came out to be Before treatment mean score came out to be 2.65mm with standard deviation of 0.99, immediately after placement of crown mean score came out to be 1.50mm with standard deviation of 1.06. At 2 weeks mean score came out to be 2.18mm with standard deviation of 1.04 and at 6 weeks mean score came out to be 2.43mm with standard deviation of 0.18. Values remained same as that of 6 weeks, when checked at 6 and 12 months. (Table 1 and Graph 1).

Table 1:

Intervals	N	Mean	SD
Pre -treatment	47	2.65	0.99
Immediately After t/t	47	1.50	1.06
2 Weeks	44	2.18	1.04
6 Weeks	43	2.43	0.18
6 Months	41	2.43	0.18
12 Months	39	2.43	0.18

Graph 1:



Overbite Score at Different Time Intervals
 Test Applied: Independent t-test

ANALYSIS AT DIFFERENT TIME PERIODS

P-value came out to be statistically significant when comparison was drawn between pre-treatment and immediately after treatment, immediately after crown placement and at 2 weeks and immediately after crown placement and at 6 weeks. (Table 2)

Table 2:

Interval	P-value
Pretreatment vs Immediately after treatment	<0.01*
Pretreatment vs 2 Weeks	0.06
Pretreatment vs 6 Weeks	0.28
Immediately after treatment vs 2 Weeks	0.01*
Immediately after treatment vs 6 Weeks	0.002*
2 Weeks vs 6 Weeks	0.41

*: statistically significant
 Intragroup comparison
 Test Applied: Tukey HSD Post Hoc Test

DISCUSSION

Evaluation on the basis of overbite score was done before treatment, immediately after treatment, at 2 weeks, at 6 weeks, at 6 months and after 12 months at the canine tip region using a manual method with the help of an indelible pencil and customized scale. According to studies by (Innes et al.2007) (Innes, Evans & Stirrups 2008) Hall crowns cause a premature contact and decrease in overbite, immediately after

their placement. They suggested that occlusion equilibrates rapidly within a few weeks, but no mention of a fixed time frame was given (14). In our study, results showed that though overbite decreased significantly after crown placement, but within 6 weeks there was just a difference of 0.2mm in overbite score in comparison to pretreatment values. Another study was done by Zee et al. in 2010 measuring the distance between the tip of the

mandibular and maxillary primary canines just before and after treatment with SSCs and again after 15 and 30 days in 48 children. The mean distance between the canine tips reduced from 2.45 mm before to 0.54 mm immediately after treatment. After 15 days the distance increased to 1.96mm and after 30 days to 2.75mm. It was observed that mean distance after 30 days was even greater than the pretreatment values (6). In our study, similar results were seen at 2 weeks period (with a difference of 0.5mm mean overbite score between pretreatment values and at 2 weeks). But at 6 weeks, the scenario was different, there was a difference of 0.2mm between mean overbite score at baseline and at 6 weeks. Though there was no statistically significant difference between pretreatment score and at 2 weeks and 6 weeks, but the overbite score was closer to pretreatment value at 6 weeks, suggesting that occlusion almost equilibrates within 6 weeks.

[Gallagher, O'Connell† & O'Connell in 2014] checked the occlusion after placement of stainless-steel crowns in children using T-Scan_ III for the measurement of occlusal contacts and total occlusal force on each tooth. The percentage of total occlusal force on each tooth was recorded in 20 children preoperatively, after SSC placement and 4 weeks postoperatively. According to authors there was a significant difference between the preoperative force on a tooth and the reading after crown placement. Because the Hall crowns are fitted without tooth preparation, the occlusion might be temporarily opened, co related with premature contacts after cementation of crowns and elevations in occlusal vertical distance. By 4 weeks, there was no significant difference between occlusal forces post-SSC placement and the preoperative value for the tooth. None of the children reported any discomfort, suggesting that occlusal disturbances in children did not cause pain or dysfunction, which has been attributed to the greater adaptability of the masticatory system to occlusal abnormalities in children. They postulated that a large increase in the VDO allowed the other teeth in the arch to re-erupt with intrusion of the restored tooth. It was postulated that larger portion of tooth movement was due to over-eruption in younger children. The eruptive potential in younger children may partly explain the resolution of premature contacts.

Possible mechanisms by which interferences were resolved included intrusion of the restored tooth, extrusion of other teeth, condylar adaption and skeletal growth (13)(15).

Similar Study Was Done by [Nair et al., 2020] where the occlusal analysis of vertical dimension and maximum intercuspal position after placement of stainless steel crown using Hall technique in children was done digitally. In the sample of 20 children, the results showed 55% of the cases had premature contacts at baseline, which was increased to 75% immediately post placement of the crowns and reduced significantly 1 month postoperatively

to 15%. The authors postulated that occlusal settlement occurs in a similar way as that of correction of overbite using posterior bite planes causing the molars extrusion and increased lower facial height, which elicited stable results, due to growth potential and the neuromuscular system adapting to the new vertical dimension, with no effects to the TMJs. (7)

The occlusal equilibration occurred within 6 weeks and remained stable thereafter in our study as well. Though, the mechanism of settlement may either be intrusion of crowned tooth and the extrusion of remaining teeth to attain proper intercuspation, but it was not evaluated in our study. The adaptability of the neuromuscular complex of a child, may further contribute to the ease of adaptation of the Hall crown. Greater research to explain the exact mechanism is warranted to better understand the dynamics of this occlusal settlement after Hall crown.

CONCLUSION

Within the limitations of the study, it was seen that occlusal equilibration take place within 6 weeks of placement of Hall crown. Statistically non-significant results were seen at 2 weeks and 6 weeks in comparison to pretreatment values, but mean overbite score at 6 weeks was closer to pretreatment value.

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