



# Does the rehabilitation treatment predispose the patient with cleft to endodontic treatment?

Sávio Brandelero Junior<sup>1\*</sup> , Renata Artioli Moreira<sup>1</sup> ,  
Lidiane de Castro Pinto<sup>2</sup> , Gisele da Silva Dalben<sup>2</sup> 

<sup>1</sup> DDS, MSc, Endodontist and Doctoral Graduate Student on Sciences of Rehabilitation, Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Bauru, Brazil.

<sup>2</sup> DDS, MSc, PHD, Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Bauru, Brazil.

**Corresponding author:**

Sávio Brandelero Junior  
Rua Silvio Marchioni, 3-20  
CEP: 17012-230  
Bauru - SP, Brazil  
saviobjr@usp.br

**Editor:** Altair A. Del Bel Cury

**Received:** Apr 25, 2022

**Accepted:** Jun 07, 2022

**Aim:** to verify the relation between endodontic treatment of teeth adjacent to the cleft area and the rehabilitation of patients with unilateral cleft lip and palate, at the Hospital for Rehabilitation of Craniofacial Anomalies. **Methods:** the present split-mouth study was composed of 406 individuals with complete unilateral cleft lip and palate who had completed the rehabilitation process in a single tertiary cleft center (55.9% males). The information was collected from the dental history on the patients' records and radiographs. The frequency of endodontic treatment in the upper incisors and canines was calculated for the cleft and non-cleft sides. The comparison between sides was performed by the chi-square test ( $p < 0.05$ ). **Results:** endodontic treatment was more frequent in teeth adjacent to the cleft than in contralateral teeth. The frequency of endodontic treatment in at least one tooth adjacent to the cleft was 18.97%, and 11.6% on the contralateral side. It was observed that endodontic treatment was necessary in 63.5% of patients who had been submitted to orthodontic treatment, 42.4% of those rehabilitated with fixed partial dentures and 12.0% of patients who underwent dental reshaping of teeth adjacent to the cleft. The treatments performed included vital pulp therapy (46.1%), non-vital pulp therapy (46.8%) and endodontic retreatment (7.1%). **Conclusion:** in individuals with complete cleft lip and palate, teeth close to the bone defect area and used for rehabilitation treatment presented greater need of endodontic intervention.

**Keywords:** Cleft palate. Cleft lip. Endodontics. Diagnosis.



## Introduction

Endodontic treatment is a relatively complex procedure. For this reason, knowledge on the anatomy of dental structures is essential, since many morphological variations can occur in patients with cleft lip and palate<sup>1</sup>. In individuals with cleft, the diagnosis of endodontic lesions becomes more challenging. Depending on the extent, the bone defect can be seen as a radiolucent area surrounding the periapical portion of teeth adjacent to the cleft. This evidences the importance of performing adequate anamnesis, physical and complementary exams for an accurate diagnosis<sup>2,3</sup>.

The need for endodontic intervention can have several etiologies. The incorrect hygiene<sup>4</sup>, due to poor positioning of teeth in the arch, can contribute to tooth decay. Exacerbated orthodontic mechanical forces, tooth resorption and prosthetic rehabilitation in the cleft area may also be related to the need for endodontic treatment<sup>5</sup>. Knowing the characteristics of individuals with clefts in all aspects is very important for endodontic treatment. Dental changes in shape, size and position, difficult cleaning and a long period of rehabilitation are frequent<sup>6</sup>. Therefore, the aim of this study was to investigate the relationship between endodontic intervention in teeth adjacent to the unilateral complete cleft lip and palate and dental rehabilitation treatment. The null hypothesis was that teeth adjacent to the cleft do not present a greater risk for endodontic treatment when compared to contralateral teeth.

## Materials and Methods

This present split mouth study was approved by the Institutional Review Board of the Hospital for Rehabilitation of Craniofacial Anomalies. A list of individuals with complete unilateral cleft lip and palate that had received hospital discharge was requested to the Hospital Informatics Service. The search retrieved 2,521 patients. From sample calculation, 406 were randomly selected to be part of the study. The information was obtained based on the patient's dental records. Sample calculation considered an alpha of 5% and test power of 80%. The sample calculation indicated a minimum sample of 288.

Data collected were gender, side affected by the cleft, type of rehabilitation at the cleft area, presence of endodontic treatment and pulp diagnosis. The experimental group (CS) included the teeth adjacent to the cleft area (central incisor, lateral incisor or canine). The control group (NCS) was composed of analysis of contralateral teeth at the non-cleft side.

After collection, data related to the individual, rehabilitation treatment and endodontic intervention were tabulated. Descriptive analysis of data related to gender, side affected by the cleft, rehabilitation modalities, pulp diagnosis and type of endodontic treatment were performed. The chi-square test ( $\chi^2$ ) was applied to compare the number of endodontic treatments between sides with and without cleft, and endodontic treatments performed concurrently or outside the period of orthodontic intervention. A p-value smaller than 5% was considered significant.

## Results

There was predominance of males, and the occurrence of complete unilateral cleft lip and palate was greater on the left side (64.1%). As for the records, 37.9% of individuals in the study were submitted to at least one endodontic treatment. Overall, 18.9% had undergone endodontic treatment in at least one tooth adjacent to the cleft, greater than on the non-cleft side (11.5%) (Table 1).

**Table 1.** Number and frequency of individuals undergoing endodontic treatment involving teeth adjacent to the cleft side compared to the non-cleft side (Pearson's chi-square test with Yates correction).

| Endodontic treatment | Cleft side | %            | Non-cleft side | %            |
|----------------------|------------|--------------|----------------|--------------|
| Absent               | 329        | 81.1         | 359            | 88.4         |
| Present              | 77         | 18.9         | 47             | 11.6*        |
| <b>Total</b>         | <b>406</b> | <b>100.0</b> | <b>406</b>     | <b>100.0</b> |

\*Represents statistically significant difference between groups (P<0.05)

When the type of rehabilitation to which these individuals were submitted was analyzed, the most common was fixed partial dentures (30.4%), followed by dental reshaping with composite resin (30%). No information was found in 103 records (Table 2).

**Table 2.** Rehabilitation modalities in individuals with complete unilateral cleft lip and palate.

| Type of rehabilitation    | N          | %            |
|---------------------------|------------|--------------|
| Fixed partial denture     | 92         | 30.4         |
| Reshaping                 | 91         | 30.0         |
| Removable partial denture | 60         | 19.8         |
| Implant                   | 41         | 13.5         |
| Complete denture          | 19         | 6.3          |
| <b>Total</b>              | <b>303</b> | <b>100.0</b> |

Among the 406 patients, 286 had undergone orthodontic treatment. The mean treatment time was 10.4 (+/- 4.7) years. Among these patients, 104 underwent endodontic treatment, of which 66 were treated during the period of orthodontic treatment, while 38 underwent endodontic treatment outside the period of orthodontic intervention (Table 3).

**Table 3.** Endodontic treatment in individuals with complete unilateral cleft lip and palate performed during or outside the orthodontic intervention period (Pearson's chi-square test with Yates correction).

| Treatment                        | n          | %            |
|----------------------------------|------------|--------------|
| Endodontics with Orthodontics    | 66         | 63.5*        |
| Endodontics without Orthodontics | 38         | 36.5         |
| <b>Total</b>                     | <b>104</b> | <b>100.0</b> |

\*Represents statistically significant differences between groups (p <0.05).

Table 4 shows the frequency of endodontic interventions associated or not with each rehabilitation modality.

**Table 4.** Need for endodontic treatment for rehabilitation with fixed partial dentures (FPD) and dental reshaping in individuals with complete unilateral cleft lip and palate.

| Treatment               | n  | %    |
|-------------------------|----|------|
| FPD + Endodontics       | 39 | 42.4 |
| FPD                     | 53 | 57.6 |
| Reshaping + Endodontics | 11 | 12.0 |
| Reshaping               | 80 | 88.0 |

The most frequent pulp diagnosis was pulp necrosis (54.0%). The most frequent endodontic treatment was non-vital pulp therapy (46.8%), followed by vital pulp therapy (46.1%) (Table 5).

**Table 5.** Pulp diagnosis, number and frequency of endodontic treatments to which individuals with complete unilateral cleft lip and palate were submitted.

| Pulp diagnosis         | N   | %    |
|------------------------|-----|------|
| healthy pulp           | 47  | 16.1 |
| reversible stage       | 11  | 3.8  |
| transition stage       | 11  | 3.8  |
| irreversible stage     | 65  | 22.3 |
| necrotic pulp          | 157 | 54.0 |
| Treatment              | n   | %    |
| Vital pulp therapy     | 136 | 46.1 |
| Non-vital pulp therapy | 138 | 46.8 |
| Retreatment            | 21  | 7.1  |

## Discussion

This is a quantitative, descriptive, retrospective and documental study, with no reports of similar studies in individuals with cleft. There was predominance of complete unilateral cleft lip and palate in the male gender (55.9%). These data agree with studies by Martelli Júnior et al.<sup>7</sup> (2006) and Cymrot et al.<sup>8</sup> (2010), who found, respectively, the frequencies in the male gender of 61%, 53.5%, 60% and 53%. Concerning side, it was observed that the left side is significantly more affected than the right. This information agrees with the studies of Carvalho and Tavano<sup>9</sup> (2008); Cymrot et al.<sup>8</sup> (2010).

Additionally, it was found that the probability of a tooth adjacent to the cleft area requiring endodontic treatment is almost two times higher when compared to contralateral teeth. Teeth adjacent to the cleft area may present adverse conditions for

the rehabilitation treatment, such as the presence of crowding, rotation, malformations of the dental structure<sup>10</sup>, partial eruption, absence of keratinized mucosa<sup>11</sup>, high prevalence of gingival recession<sup>12</sup>, shallow vestibule<sup>13</sup> and hygiene difficulties<sup>14</sup>. The negligent hygiene can cause dental caries and, consequently, gingival, periodontal and endodontic changes<sup>15</sup>. This fact becomes worrying when it was found that 37.9% of individuals in the sample needed at least one endodontic intervention.

Fixed orthodontic devices such as bands, brackets, elastics, and arches are also complicating factors, since they influence the biofilm accumulation and can lead to enamel decalcification and caries<sup>16</sup>. Among the individuals evaluated, 63.5% who used brackets required at least one endodontic intervention during orthodontic treatment. The mean duration of orthodontic treatment was 10 years and 4 months. According to Ahluwalia et al.<sup>17</sup> (2004), individuals with clefts need longer treatment than individuals without clefts. However, orthodontics cannot always solve more complex cases, such as those with marked discrepancies. In these situations, orthognathic surgery is indicated and often must be planned together with prosthetic rehabilitation, to establish a good prognosis<sup>18</sup>. The present study demonstrated that 63.7% needed some type of prosthesis during rehabilitation. This agrees with Siqueira et al. (2021)<sup>5</sup>, who found that 30% of individuals with clefts need some type of prosthesis. Therefore, the need of fixed partial dentures led to greater need of endodontic treatment for rehabilitation procedures at the cleft areas<sup>5</sup>.

The esthetic function includes improving the individual's profile, supporting the upper lip and aligning the teeth. Individuals with cleft lip and palate usually have a low smile line, that is, most of these individuals do not have exposure of teeth and gingival tissues when smiling, which facilitates cosmetic prosthesis, even in the absence of bone or gingival tissue<sup>19,20</sup>. Treatment with fixed partial dentures is still widely indicated, especially in case of failure or impossibility of performing the alveolar bone graft<sup>21</sup>. When the graft is performed satisfactorily and in the ideal period of rehabilitation, orthodontic treatment is only complemented with dental revitalization, mainly because these individuals frequently present changes related to shape, size, number and position. In some cases, the canine assumes the position of the lateral incisor in the arch and it is necessary to transform the shape of this tooth to maintain the function and esthetics<sup>2</sup>. This type of rehabilitation is generally less traumatic for the dental structure. This fact can be confirmed by the results obtained, in which only 12.0% of reshaped teeth required endodontic treatment<sup>22</sup>.

The most frequent endodontic diagnosis was necrotic pulp (54.0%), followed by irreversible pulpitis (22.3%). Regarding the type of endodontic treatment performed, it was found that non-vital pulp therapy was the most frequent with 46.8%, followed by vital pulp therapy (46.1%). In the study by Hussne et al.<sup>6</sup> (2009), 1377 teeth were evaluated. Non-vital pulp therapy was the most frequently performed therapy (51.34%), followed by vital pulp therapy (36.60%) and endodontic retreatment (12.06%). The authors also found that the main reason for performing endodontic treatment in individuals with clefts was dental caries (56.14%), followed by prosthetic purposes (18.95%)

The high prevalence of dental caries and the frequent need for prosthetic rehabilitation of these individuals increase the likelihood of the need for endodontic treatment. Many individuals present themselves for reparative surgeries without ever having

received any dental assistance, presenting decayed teeth with substantial loss of dental structure and the need for extensive oral rehabilitation. In addition to the peculiar characteristics of these individuals, the socioeconomic and geographic aspects can contribute to this situation. The difficult access to adequate treatment due to the distance from specialized centers and the refusal of many professionals to treat individuals with cleft, due to insecurity or lack of knowledge, end up restricting oral health care to many of these individuals<sup>23</sup>.

However, rehabilitative procedures must be performed at a suitable period to not jeopardize the craniofacial growth and development. Moreover, it is imperative to combine a specialized and qualified multidisciplinary team with clinical care and surgical experience<sup>24,25</sup>.

In conclusion, teeth adjacent to the alveolar cleft are at greater risk for endodontic treatment when compared to the contralateral teeth, especially during the period of orthodontic treatment and when there is need to rehabilitate the cleft area with partial fixed denture. This shows the importance of dental support during the rehabilitation process in efforts aimed at preserving the teeth and maintaining the volume of alveolar bone adjacent to the cleft.

## Data availability

Datasets related to this article will be available upon request to the corresponding author.

## Conflict of interests

None.

## Author contribution

**Sávio Brandelero Junior** – Contributed substantially to the conception and design of the study, the acquisition of data, the manuscript's findings, and the analysis and interpretation, have revised and approved the final version of the manuscript.

**Renata Artioli Moreira** – Contributed substantially to the conception and design of the study, the acquisition of data, the manuscript's findings, and the analysis and interpretation, have revised and approved the final version of the manuscript.

**Lidiane de Castro Pinto** - agree to be accountable for all aspects of the work as the manuscript's findings, in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved, have revised, and approved the final version of the manuscript.

**Gisele da Silva Dalben** - the manuscript's findings, drafted or provided critical revision of the article. Provided final approval of the version to publish. Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

All authors actively participated in the manuscript's findings, and have revised and approved the final version of the manuscript.

---

## References

1. Arora A, Batra P, Sood SC, Raghavan S, Sood A. Comparison of dentofacial morphology between parents of children with and without craniofacial anomalies using cephalogram imaging. *Indian J Dent Res.* 2021 Oct-Dec;32(4):472-9. doi: 10.4103/ijdr.ijdr\_623\_21.
2. Pinheiro CR, de Castro Pinto L, Mateo-Castillo JF, Siqueira V da S, Garib D. Response to pulp vitality tests in teeth submitted to orthodontic movement, adjacent to the cleft area. *Cleft Palate Craniofac J.* 2022 Jan;59(1):72-8. doi: 10.1177/1055665621996115.
3. Khademi AA, Shahtouri MM, Attar BM, Rikhtegaran N. Pulp vitality of maxillary canines after alveolar cleft bone grafting: pulse oximetry versus electric pulp test versus cold Test. *J Craniofac Surg.* 2021 May;32(3):e314-7. doi: 10.1097/SCS.0000000000002544.
4. Siqueira VDS, Castillo AES, Mateo-Castillo JF, Pinto LDC, Garib D, Pinheiro CR. Dental hypersensitivity in individuals with cleft lip and palate: origin and therapies. *J Dent Res Dent Clin Dent Prospects.* 2021 Winter;15(1):42-6. doi: 10.34172/joddd.2021.008.
5. Siqueira VS, Mateo-Castillo J-F, Pinto LC, Garib D, Pinheiro C-R. Etiological factors commonly related to the need of endodontic treatment in individuals with orofacial clefts. *J Clin Exp Dent.* 2021 Jun;13(6):e580-5. doi: 10.4317/jced.57980.
6. Hussne RP, Berbert FL, Nishiyama CK, Câmara AS, Pinheiro CR, Leonardo RT. Investigation of the endodontic needs and planning in patients with cleft lip and or palate submitted to surgical treatment. *Perspect Oral Sci.* 2009;1(2):19-23.
7. Martelli Júnior H, Orsi Júnior J, Chaves MR, Barros LM, Bonan PRF, Freitas JAS. [Epidemiologic study of cleft lip and palate in Alfenas - Minas Gerais - from 1986 to 1998]. *RPG Rev Pos-Grad.* 2006 Jan-Mar;13(1)31-5. Portuguese.
8. Cymrot M, Sales FCD, Teixeira FAA, Teixeira Junior FAA, Teixeira GS, Cunha Filho JFO, et al. [Prevalence of kinds of cleft lip and palate at a Pediatric Hospital in Northeast of Brazil]. *Rev Bras Cir Plást (Impr).* 2010;25(4):648-51. Portuguese. doi: 10.1590/S1983-51752010000400015.
9. Carvalho LCF, Tavano O. [Dental agenesis in cleft lip and/or palate pf the Centro Pró-Sorriso - Universidade José do Rosário Vellano]. *RGO.* 2008;56(1):39-45. Portuguese.
10. Ruiz LA, Maya RR, D'alpino PHP, Atta MT, da Rocha Svizero N. Prevalence of enamel defects in permanent teeth of patients with complete cleft lip and palate. *Cleft Palate Craniofac J.* 2013 Jul;50(4):394-9. doi: 10.1597/11-200.
11. Almeida ALPF, Esper LA, Kaizer ROF, Fernandes JS, Gregghi SLA, Carrilho GPB. Surgical treatment of mucogingival alterations in cleft lip and palate patients: a clinical report. *Periodontal Pract Today.* 2006 Jan;3(1):31-5.
12. De Almeida ALPF, Esper LA, Pegoraro TA, Valle ALD. Gingival recession in individuals with cleft lip and palate: prevalence and severity. *Cleft Palate Craniofac J.* 2012 Jan;49(1):92-5. doi: 10.1597/10-052.
13. de Almeida AL, Pedro PF, Kogawa EM, Pereira T, de Barros Carrilho GP, Aiello CA, et al, Comparative evaluation of two different vestibuloplasty surgical procedures in cleft patients: a pilot study. *Cleft Palate Craniofac J.* 2005 Jul;42(4):439-41. doi: 10.1597/04-052r.1..
14. Brasil JMP, Pernambuco RA, Dalben GS. Suggestion of an oral hygiene program for orthodontic patients with cleft lip and palate: findings of a pilot study. *Cleft Palate Craniofac J.* 2007 Nov;44(6):595-7. doi: 10.1597/06-057.1.
15. Al-Dajani M. Comparison of dental caries prevalence in patients with cleft lip and/or palate and their sibling controls. *Cleft Palate Craniofac J.* 2009 Sep;46(5):529-31. doi: 10.1597/08-003.1.
16. Pilli LN, Singaraju GS, Nettam V, Keerthipati T, Mandava P, Marya A. An Extensive comparison of the clinical efficiency of Acidulated Phosphate Fluoride (APF) and Neutral Sodium Fluoride (NaF)

- oral rinses in the prevention of white spot lesions during fixed orthodontic treatment: a randomized controlled trial. *Biomed Res Int*. 2022 Mar;2022:6828657. doi: 10.1155/2022/6828657.
17. Ahluwalia M, Brailsford SR, Tarelli E, Gilbert SC, Clark DT, Barnard K, et al. Dental caries, oral hygiene, and oral clearance in children with craniofacial disorders. *J Dent Res*. 2004 Feb;83(2):175-9. doi: 10.1177/154405910408300218.
  18. Fukuda M, Takahashi T, Yamaguchi T, Kochi S, Inai T, Watanabe M, et al. Dental rehabilitation using endosseous implants and orthognathic surgery in patients with cleft lip and palate: report of two cases. *J Oral Rehabil*. 2000 Jun;27(6):546-51. doi: 10.1046/j.1365-2842.2000.00539.x.
  19. Esper LA, Sbrana MC, Ribeiro IWJ, Siqueira de EN, de Almeida ALPF. Esthetic analysis of gingival components of smile and degree of satisfaction in individuals with cleft lip and palate. *Cleft Palate Craniofac J*. 2009 Jul;46(4):381-7. doi: 10.1597/07-189.1.
  20. Fiamengui Filho JFF, De Almeida ALPF. Aesthetic analysis of an implant-supported denture at the cleft area. *Cleft Palate Craniofac J*. 2013 Sep;50(5):597-602. doi: 10.1597/11-193.
  21. Watanabe I, Kurtz KS, Watanabe E, Yamada M, Yoshida N, Miller AW. Multi-unit fixed partial denture for a bilateral cleft palate patient: a clinical report. *J Oral Rehabil*. 2005 Aug;32(8):620-2. doi: 10.1111/j.1365-2842.2005.01468.x.
  22. Janiszewska J, Wędrychowska- Szulc B. [Missing permanent tooth buds] *Magazyn Stomatol*. 2000;10(4):42-3. Polish
  23. Freitas JA, Almeida AL, Soares S, Neves LT, Garib DG, Trindade-Suedam IK, Yaedú RY, et al. Rehabilitative treatment of cleft lip and palate: experience of the Hospital for Rehabilitation of Craniofacial Anomalies/USP (HRAC/USP) - Part 4: oral rehabilitation. *J Appl Oral Sci*. 2013;21(3):284-92. doi: 10.1590/1679-775720130127.
  24. Global strategies to reduce the health care burden of craniofacial anomalies: report of WHO meetings on international collaborative research on craniofacial anomalies. *Cleft Palate Craniofac J*. 2004 May;41(3):238-43. doi: 10.1597/03-214.1.
  25. Freitas J de S, Neves LT das, Almeida ALPF de, Garib DG, Trindade-Suedam IK, Yaedú RYF, et al. Rehabilitative treatment of cleft lip and palate: experience of the Hospital for Rehabilitation of Craniofacial Anomalies/USP (HRAC/USP)-Part 1: overall aspects. *J Appl Oral Sci*. 2012 Feb;20(1):9-15. doi: 10.1590/s1678-77572012000100003.