Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 3 Issue2 April-June 2017

Original article

Influence of Full Mouth Rehabilitation on Iron Deficiency Anemia Status In Children With Severe Early Childhood Caries

Uma Nagarajan [1], Renuka Dhingra [2], Payal Chaudhuri [3], Busi Karunanand [4], Poonam Arora[5]

[1] Post graduate Student, Department of Pedodontics and Preventive Dentistry, Faculty of Dental Sciences, SGT University, Budhera, Gurgaon
[2] Professor, Department of Pedodontics and Preventive Dentistry, Faculty of Dental Sciences, SGT University, Budhera, Gurgaon
[3] Reader, Department of Pedodontics and Preventive Dentistry, Faculty of Dental Sciences, SGT University, Budhera, Gurgaon
[4]Professor and Head, Department of Biochemistry, Faculty of Medicine & Health Sciences, SGT University, Budhera, Gurgaon
[5]Assistant Professor, Department of Biochemistry, Faculty of Medicine & Health Sciences, SGT University, Budhera, Gurgaon

A R T I C L E I N F O

Keywords:
severe early childhood caries, iron deficiency anemia, full mouth rehabilitation, low weight, pulpal pathology

A B S T R A C T

Objective: The aim of the present study was to assess the influence of full mouth rehabilitation on the status of iron deficiency anemia in children with severe early childhood caries (SECC). **Study design**: A total of thirty children were included in the study between the ages of two to six years. Children who were otherwise healthy but had SECC were assessed for symptoms of iron deficiency anemia (IDA) and were referred to the pediatrician who then recommended tests to confirm IDA. These children with both SECC and IDA were included in the study. A full mouth rehabilitation was carried out for these children. About three months post full mouth rehabilitation, another blood investigation was carried out and the baseline values and post-op values of various parameters were compared to assess the difference. **Result**: Significant improvements in the various parameters tested were observed after full mouth rehabilitation. **Conclusion**: There is a positive correlation between SECC and low weight and presence of iron deficiency anemia in these children and that on treating the pulpal pathology, resolution of iron deficiency anemia can be achieved.

Introduction

Early childhood caries (ECC) is a rapidly spreading infectious disease. ECC is a serious public health issue in both developed as well as developing countries. Apart from affecting the health of the child particularly, it has a social and economic significance as well.[1-3]

Prevalence of ECC is between 1- 12% in developed countries.[2,4] Virdi M and colleagues reported a prevalence rate of 42.03% in Bahadurgarh, Haryana region.[5]

ECC is not limited to just affecting the oral hygiene of the child, but also affects the child's overall health and quality of life. Due to the pain and discomfort caused by the untreated carious lesions and various pulpal pathologies, the child is unable to eat and there is a marked weight loss observed when compared with caries free children.

There is an altered sleep pattern due to nocturnal pain leading to a disturbed glucosteroid production. Low levels of

* *Corresponding author:* ***Dr. Uma Nagarajan, Address- Flat no 3-C, Pocket A-10, Kohinoor Apartments, Kalkaji Extension, New Delhi- 110019, Phone number: +918527008161, Email ID: umanagarajan0602@yahoo.com, umanagarajan0602@gmail.com***

hemoglobin leading to iron deficiency anemia is also observed due to a disturbance in production of the erythrocytes.[2,6,7] A different mechanism involving the cytokines produced by the body in response to the chronic inflammatory condition due to pulpitis and abscesses affects erythropoiesis.[2, 8]

Iron deficiency can affect a child's physical and mental growth and development and is diagnosed by low hemoglobin or ferritin level.[9] Health Survey (NFHS) 2005- 2006 revealed that at least 80% of Indians among rural children aged between 12 to 23 months were anemic.[10]

Other effects of ECC would involve a failure to thrive, inabilities to concentrate and greater days of absence from school and low self-esteem.[2, 11]

There is need for further studies to determine the systemic consequences of severe early childhood caries children such as malnourishment resulting in poor body weight and nutrient deficiency, particularly of iron, in the rural area of Gurgaon, Haryana. Moreover, studies assessing the effect of full mouth rehabilitation on iron deficiency anemia are sparse, thus with this background in mind, this study was conducted with the following aims and objectives:

- To assess if young children without any systemic illness with severe early childhood caries have less weight compared to national norms by ICMR[12]
- To determine the association between Severe Early Childhood Caries and iron deficiency anemia as measured by Hemoglobin and other blood parameters such as Mean corpuscular volume, Mean Corpuscular Hemoglobin Concentration, Hematocrit (PCV) and Serum Ferritin values.
- To assess the influence of full mouth rehabilitation on iron deficiency anemia status and weight in children with S-ECC.

Materials and method

Children aged between 2-6 years of age with multiple decayed teeth were randomly selected from the outpatient Department of Pedodontics & Preventive Dentistry, Faculty of Dental Sciences, SGT University, Budhera, Gurgaon, as per the following inclusion and exclusion criteria.

Inclusion criteria

1. Healthy children between 2-6 years of age with no chronic illness
2. Presence of SECC pathology:

- In children younger than 3 years of age: any sign of smooth surface caries.
- In children of 3-year age: Decayed, missing, or filled score of ≥4.
- In children of 4-year age: Decayed, missing, or filled score of ≥5.
- In children of 5-year age: Decayed, missing, or filled score of ≥6.

To determine the effect of full mouth rehabilitation on status of iron deficiency anemia, the child had to fulfil the following additional criteria:

- Presence of at least 2 pulpally involved teeth
- Presence of Iron deficiency anemia

30 children were selected for this objective.

Exclusion criteria

1. Chronic or acute illness
2. Known blood dyscrasia
3. Any known form of haemoglobinopathy
4. Children who had undergone abdominal surgery
5. Presence of any malignancy

6. Preterm children
7. Children consuming allopathic or herbal medication

Methodology

This study was carried out in the Department of Pedodontics & Preventive Dentistry, Faculty of Dental Sciences, SGT University in association with the Department of Pediatrics and Department of Biochemistry, SGT Medical College and Hospital. An approval from the ethical committee of S.G.T University was taken to carry out this study.

Each child reporting to the Department was examined for the presence of early childhood caries using visual, tactile and radiographic examinations by the investigator. The deft scores were recorded for these children and children who presented with SECC were selected.

A general physical examination was conducted in the children with SECC for presence of signs of anemia such as pallor of the palm, nails and eyelids, tiredness, weakness, low appetite and dizziness. Once these signs were observed in the patients, they were then referred to Pediatrics Department for opinion and advice regarding the estimation of blood parameters to detect presence or absence of iron deficiency anemia.

Weight measurements were taken for each child in light clothes and no shoes. Weight was measured in kilograms using standard weighing machine after calibration. Average weight of the sample children were then compared with weight for age according to ICMR norms.

When signs of anemia were observed, the child underwent a blood test to confirm the presence of iron deficiency anemia as advised by the consulting pediatrician.

A sample of approximately 5 ml of blood was drawn from the child from the anesthesia venipuncture site after taking written consent from the parents. The blood test was used for estimation of Haemoglobin (Hb), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC), Hematocrit and Serum Ferritin to diagnose anemia. Anemia due to nutritional deficiency can be provisionally diagnosed by Hb level <12 g/dl, MCV < 76 μm^3, MCHC <33 gm/dl, Hematocrit value <39% and serum ferritin <24 ng/mL.

Once the child fulfilled the inclusion criteria, full mouth rehabilitation was done which included restorations, pulp therapy (pulpotomy and pulpectomy), crown cementation and space maintainers. They were recalled after 3 months and weight was recorded again. A subsequent blood sample was collected to check for the status of Iron deficiency anemia and levels of Hb, MCV, MCHC, Hematocrit (PCV) and Serum Ferritin.

During this time period the children were not provided with any iron supplementation or any other medication so as to assess the effect of full mouth rehabilitation on iron deficiency anemia status.

The baseline and post full mouth rehabilitation values of blood parameters were then compiled and analysed. Student's paired T test was applied with significance level set at p- value <0.05.

Results

A total of 51 children were assessed for presence of both SECC and signs of anemia who were advised to undergo a complete hemogram which included Hb, MCV, MCHC, PCV and Serum Ferritin. 45 children were selected for the study because 6 parents did not give consent for the blood test. Low weight was observed in 41 of 45 of these children (91%). Iron

deficiency Anemia was present in 42 of 45 children (93%). These 42 children were then included in the

Parameter	Baseline Mean± SD	3 months post full mouth rehabilitation Mean± SD	95% CL for difference	P value (significant when <0.05)
Hb (g/dL)	10.54± 1.24	11.56± 1.36	-1.4 to -0.6	0.00001*
MCV (μm^3)	67.5±10.6	73.4± 11.4	-9.1 to -2.6	0.0008*
MCHC(%)	31.2± 2.57	32.6± 1.6	-2.1 to -0.57	0.001*
PCV (%)	33.02± 2.69	35.54± 3.09	-3.5 to -1.4	0.00004*
Serum Ferritin (ng/mL)	14.7± 17.6	25.7± 22.5	-18.8 to -3.27	0.007*
Weight (Kg)	13.8± 1.82	14.9± 1.37	-1.6 to -0.6	0.00009*

*Statistically significant

Table 1: Comparison between baseline and post- operative blood parameters of Hb, MCV, MCHC, PCV and Serum ferritin and Weight (n= 30)

study. 12 patients did not turn up for the postoperative blood evaluation and thus, were eliminated from the study. A total of 30 children (22 males, 8 females) were finally included for the study with a mean deft of 9.46±3.95.

The result obtained showed a statistically significant improvement in the values of Hb, MCV, MCHC, PCV and Serum ferritin and weight when assessed 3 months after completion of full mouth rehabilitation.

Presence of low Hb, MCV, MCHC, PCV, Serum Ferritin signifies presence of IDA. The WHO states that if atleast two out of the three parameters of Hb, MCV and Serum ferritin are less than normal, the presence of IDA is confirmed. According to the results obtained in our study, the mean at baseline for these three parameters were less than normal and showed a statistically significant improvement after completion of full mouth rehabilitation.

Lower than normal weight according to age and sex were also observed which showed a statistically significant improvement when assessed 3 months following full mouth rehabilitation.

Discussion

ECC has an impact on oral health as well as general health of the child. If left untreated, child faces difficulty in chewing and eating, insufficient and retarded growth and development, disturbed sleep pattern, poor esthetics/ phonetics, low self- esteem, malnutrition. ECC may also lead to iron deficiency due to malnutrition.[13]

Iron deficiency (ID) is defined by an abnormal iron biochemistry with or without the presence of anemia and is an outcome of inadequate bioavailable dietary iron, increased iron requirement during rapid growth, and increased blood loss for any reason.[14]

Ferri C et al reported an association between IDA and consumption of cow's milk by hindering iron absorption and causing occult blood loss. Introduction to cow milk in infants less than 12 months of age is likely to result in the child developing IDA. The fact that most of the children reporting with SECC reported of a diet mainly constituting of bovine milk along with sugar could be suggestive of this association.[15]

Several mechanisms are associated with SECC leading to IDA. First, pulpitis resulting in release of various inflammatory mediators, mainly interleukin I and cytokines. Second, nocturnal pulpal pain disturbs the

sleep pattern leading to decreased glucosteroid production. These then suppress erythropoiesis resulting in anemia of chronic inflammation. Third, due to the discomfort caused by cavitations, the child resorts to consuming empty calories in the form of various fermentable carbohydrates. This again results in the child not receiving the adequate nutrients through the diet.[8,16, 17]

This study was a cross sectional study conducted with a sample size of 30 children. According to the WHO, the affected pattern of eating is manifested in young children between 3- 6 years of age. The AAPD describes ECC as presence of smooth surface caries in a child less than 6 years of age. Keeping these factors in mind, the age group included in this study was 2-6 year old children. [17,18,] Healthy children without any chronic illness were selected for this study.

Children satisfying the inclusion criteria were referred to the pediatrician who recommended a complete hemogram. The blood samples were collected by a trained laboratory technician and were assessed. The pediatrician and the lab technician were both blind to the deft status of the children to avoid bias.

In this study, the mean weight of the sample at baseline was 13.8± 1.82, which is less than the national norms prescribed by the ICMR. This finding was similar to various other studies in the literature. Acs G et al[6] found that 8.7% of the 3 year old children with nursing caries weighed less than 80% of their weight, while only 1.7% of the control group children weighed less than normal. There was a difference of atleast 1 kg in the weight of children with SECC and control group.[7, 8] Clarke M et al[19] deduced that 17% of children with SECC were malnourished. Tang R-S et al[20] reported 30% of children with SECC weighed less than normal. Edalat A et al[21], however found no linear correlation between SECC and weight.

On evaluation of weight following full mouth rehabilitation, the mean weight was 14.9± 1.37. There was an increase in weight by 1 kg which was also observed by Acs G et al[7], Mohammadi TM et al[3] and Sachdev J et al[22]. Thomas CW and Primosch RE[23] however did not confirm the presence of catch up growth.

The weight loss could be attributed to the fact that children with SECC experience pulpal pain and sensitivity which makes it difficult for them to eat. They consume increased quantity of carbohydrate rich food before caries onset. Once the carious lesions advance and reach the pulp the food habits are altered. [2,24,25]

The WHO defined iron deficiency anemia as presence of lower than reference values of any two out of Hb, MCV and serum ferritin.

In our study, out of the 45 children advised for a complete hemogram, 42 (93%) of them showed presence of IDA. 30 children reported for the final hemogram. The values of parameters tested were assessed using student's paired t test with significance when p value <0.05.

Mean Hb at baseline was reported to be 10.54± 1.24 g/dL at baseline which according to the reference range utilized is low. Similar results were reported by Clarke M et al[9] showing low values for hemoglobin in 2-6 years old children with SECC and a high prevalence of anemia (28%). Schroth RJ et al[26] also reported that children with SECC had a lower mean Hb levels as compared to the control subjects.

3 months postoperative mean of Hb in our study reported a significant improvement with p value of 0.0001. In our study, 76.6% of the population showed

a significant improvement in Hb levels with 40% of the sample assessed reporting complete resolution of IDA with Hb levels crossing 12 g/dL. 6.6% of the sample showed same level of Hb after full mouth rehabilitation and 16.6% reported a further decrease in Hb level after rehabilitation. This decrease in Hb is attributed to the fact that the child had still not developed an intake of healthy balanced diet. Despite diet counselling and all other measure taken, the parents were still unable to incorporate healthy eating habits. The children were still consuming cariogenic food which was providing them with empty calories instead of proper nutrients. These children were then referred to the pediatrician for further management of IDA.

Similarly significant differences were observed in MCV levels with p value of 0.0008. Low MCV is suggestive of microcytic anemia, which is the characteristic feature observed in iron deficiency anemia. Shaoul et al[27] however did not find any significant difference in MCV levels after treatment.

PCV levels also showed a statistically significant improvement following dental rehabilitation with p value 0.00004. Tang R-S et al[20] in their study reported 14% of their sample having low PCV. This finding is congruent with our study as well.

Statistically significant differences were observed in MCHC levels (p= 0.001), Serum Ferritin levels (p = 0.007) and weight (p= 0.00009) following treatment. This was similar to the study by Shaoul et al[27] who reported a significant improvement in levels of Hb and ferritin 4-6 months after dental rehabilitation. They were the first authors to derive a significant finding showing that treating dental caries leads to a parallel resolution of IDA. Sadhegi M et al[28], however, found no association between serum ferritin levels and ECC.

In this study, we found an increase in Hb by 1.02 g/dL following full mouth rehabilitation. Scott SP et al[29] in a systematic review stated that for each unit increase in Hb, the risk of child death falls by 24%.

This study was not without its limitations. The sample population was not matched for sex. The size of the sample selected can also be increased to cover a larger population, but was not possible due to increased drop out numbers. The samples were also not match for socioeconomic status. Since low socioeconomic background is a risk indicator for SECC, majority of the children in the study were from low income families.

There is very little literature showing the correlation of resolution of dental lesions leading to improvement in iron deficiency anemia status. This study showed a strong association between SECC and IDA. This is the first study in India which shows that the resolution of SECC can lead to improvement in growth and nutritional status of the child. Further studies must be done to find an accurate relationship for the same amongst various populations to get an accurate relationship and correlation between SECC and IDA.

Conclusion

Oral health for a long time has been linked to the overall health of an individual. As a pediatric dentist it is very common to see patients with extensive tooth decay complaining of pain.

This study reports a strong positive correlation between SECC and low weight and presence of iron deficiency anemia. On treating the pulpal pathology, resolution of iron deficiency anemia and an improvement in weight can be achieved.

Minimal research has been done with regards to the effect of dental treatment on iron deficiency anemia

and it must be treated as an area to be explored further in different populations.

References

1.Jaykumar HL, Chandra MK, Pallavi N H, Jyothi D. Management of early childhood caries A perpetual Challenge To Clinician. J Oral Health Comm Dent 5:4-11, 2011.

2.Colak H, Dülgergil CT, Dalli M and Hamidi MM. Early childhood caries update:
A review of causes, diagnoses, and treatments. J Nat Sci Biol Med 4:29-38, 2013.

3. Mohammadi TM, Kay EJ. Effect of dental caries on children growth. INTECH Open Access Publisher; 2012.

4. Burt BA, Eklund SA. Dentistry, dental practice, and the community. 5th ed. Saunders Philadelphia: 227–228, 1999

5. Virdi M, Bajaj N, Kumar A. Prevalence of severe early childhood caries in preschool Children in Bahadurgarh, Haryana, India. The Internet Journal of Epidemiology 8, 2010.

6. Acs G, Lodolini G, Kaminsky S, Cisneros GJ. Effect of nursing caries on body weight in a pediatric population. Pediatric dentistry 14:303, 1992.

7. Acs G, Shulman R, Ng MW, Chussid S. The effect of dental rehabilitation on the body weight of children with early childhood caries. Pediatr Dent 21:109-13, 1992.

8. Sheiham A. Dental caries affects body weight, growth and quality of life in pre-school children. British dental journal 201:625-6, 2006.

9. WHO C. Worldwide prevalence of anaemia 1993-2005. WHO global database on anaemia, 2008.

10. Pasricha SR, Black J, Muthayya S, Shet A, Bhat V, Nagaraj S et al. Determinants of anemia among young children in rural India. Pediatrics 126:e140-9, 2010.

11. Elice CE, Fields HW. Failure to thrive: review of the literature, case report and implications for dental treatment. Pediatr Dent 12:185-9, 1990.

12. Nutrient requirement and dietary allowances for Indians. ICMR 1990 (Reprinted 2004):7-8

13. Fung MH, Wong MC, Lo EC, Chu CH. Early Childhood Caries: A Literature Review. Journal of Oral Hygiene & Health 2013, 2013.

14. Prakash P, Subramaniam P, Durgesh BH, Konde S. Prevalence of early childhood caries and associated risk factors in preschool children of urban Bangalore, India: A cross-sectional study. European journal of dentistry 6:141, 2012.

15. Ferri C, Procianoy RS, Silveira RC. Prevalence and risk factors for iron-deficiency anemia in very-low-birth-weight preterm infants at 1 year of corrected age. Journal of tropical pediatrics fmt077, 2013.

16. Means RT, Krantz SB. Progress in understanding the pathogenesis of the anemia of chronic disease. Blood 80:1639-47, 1992.

17. Bansal K, Goyal M, Dhingra R. Association of severe early childhood caries with iron deficiency anemia. Journal of Indian Society of Pedodontics and Preventive Dentistry 34:36, 2016.

18. American Academy of Pediatric Dentistry: Classification, consequences, and preventive strategies. Pediatr Dent Reference Manual 38:52-54, 2016- 17.

19. Clarke M, Locker D, Berall G, Pencharz P, Kenny DJ, Judd P. Malnourishment in a population of young children with severe early childhood caries. Pediatric dentistry 28:254-9, 2006.

20. Tang R-S, Huang M-C, Huang S-T. Relationship between dental status and anemia in children with severe early childhood caries. The Kaohsiung Journal of Medical Sciences 29:330–336, 2013.

21. Edalat A, Abbaszadeh M, Eesvandi M, Heidari A. The relationship of severe early childhood caries and body mass index in a group of 3-to 6-year-old children in Shiraz. Journal of Dentistry 15:68, 2014.

22. Sachdev J, Bansal K, Chopra R. Effect of Comprehensive Dental Rehabilitation on Growth Parameters in Pediatric Patients with Severe Early Childhood Caries. International journal of clinical pediatric dentistry 9:15.

23. Thomas CW, Primosch RE. Changes in incremental weight and well being of children with rampant caries following complete dental rehabilitation. Pediatr Dent 24:109-113, 2002.

24. Losso EM, Tavares MC, da Silva JY, Urban CD. Severe early childhood caries: an integral approach. Jornal de pediatria 85:295-300, 2009.

25. Kawashita Y, Kitamura M, Saito T. Early childhood caries. International journal of dentistry 2011, 2011.

26. Schroth RJ, Levi J, Kliewer E, Friel J, Mofatt MEK. Association between iron status, iron deficiency anaemia, and severe early childhood caries: a case-control study. BMC Pediatrics 13:22, 2013.

27. Shaoul R, Gaitini L, Kharouba J, Darawshi G, Maor I, Somri M. The association of childhood iron deficiency anaemia with severe dental caries. Acta Paediatrica 101:e76-9, 2012.

28. Sadeghi M, Darakhshan R, Bagherian A. Is there an association between early childhood caries and serum iron and serum ferritin levels? Dent Res J (Isfahan) 9: 294-8, 2012.

29. Scott SP, Chen-Edinboro LP, Caulfield LE, Murray-Kolb LE. The impact of anemia on child mortality: an updated review. Nutrients 6 :5915-32, 2014.