



## Journal of Advances in Medicine and Medical Research

28(3): 1-7, 2018; Article no.JAMMR.44638

ISSN: 2456-8899

(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614,  
NLM ID: 101570965)

# Prevalence of Root Caries in South Canara Population

Mithra Nidarsh Hegde<sup>1</sup>, Mrinalini<sup>1\*</sup> and Nireeksha Shetty<sup>1</sup>

<sup>1</sup>Department of Conservative Dentistry and Endodontics, A B Shetty Memorial Institute of Dental Sciences, Nitte University, Mangaluru, Karnataka, India.

### Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

### Article Information

DOI:10.9734/JAMMR/2018/44638

#### Editor(s):

(1) Dr. Ibrahim El-Sayed M. El-Hakim, Professor, Ain Shams University, Egypt and Riyadh College of Dentistry and Pharmacy, Riyadh, Saudi Arabia.

(2) Dr. James Anthony Giglio, Adjunct Clinical Professor, Oral and Maxillofacial Surgery, School of Dentistry, Virginia Commonwealth University, Virginia, USA.

#### Reviewers:

(1) Alicia Noemí Kohli Bordino, Italian University Institute of Rosario, Argentina.

(2) A. O. Ehizele, University of Benin, Nigeria.

(3) Danielle Wajngarten, São Paulo State University, Brazil.

Complete Peer review History: <http://www.sciencedomain.org/review-history/27539>

Original Research Article

Received 21 September 2018

Accepted 20 November 2018

Published 01 December 2018

## ABSTRACT

**Aim:** Aim of the present study was to determine the prevalence of root caries and associated risk factors among South Canara population.

**Place of Study:** Department of Conservative Dentistry and Endodontics, A.B. Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangaluru and rural satellite centres.

**Duration of Study:** MAY 15 2018- JUNE 15 2018 (1 month).

**Methodology:** 2000 patients were examined for root caries using mouth mirror and explorer under good lighting facilities, followed by a questionnaire to determine the prevalence of root caries and associated risks in South Canara Population.

**Statistical Analysis:** Data obtained was statistically analysed by using IBM SPSS version 24. Differences between variables were analysed by Chi-square test.

**Results and Conclusion:** Root caries were diagnosed in 7.4% of the patients examined. Root caries was more common in males (63.51%), in the age group of more than 60 years (56.76%) and in the rural population (62.16%). Oral hygiene and diet were also found to be closely associated with root caries. Molars were most affected and mandibular teeth were more frequently involved with root caries than teeth in the maxilla.

\*Corresponding author: E-mail: [mrinalinioshin@gmail.com](mailto:mrinalinioshin@gmail.com);

**Keywords:** Root caries; diet; oral hygiene practice.

## 1. INTRODUCTION

The life expectancy of individuals has increased over a period of time and so is their ability to retain teeth [1]. With increasing age, periodontal tissues are compromised leaving the root surface exposed and making it more susceptible to root caries [2]. The presence of root caries has been shown to be increasing over the past few years [3].

A study conducted by Hayes in 2017 showed that the prevalence of root caries was as high as 25-100% globally with the mean root caries index 9.7-38.7 [4].

Cariogenic biofilm and fermentable carbohydrates are considered to be the main etiological factor for the development of root caries [5]. The fermentable carbohydrate is converted to acid by cariogenic flora which leads to demineralisation of root surfaces. For coronal caries, the process of demineralisation begins at a pH of 5.5. Dentin demineralisation occurs at a slightly higher pH of 6.0-6.8 [2]. The initiation of root caries involves the process of demineralisation and remineralisation, and the progression occurs when environment favours demineralisation [6]. Also, unlike coronal caries, root caries is associated with demineralisation as well as collagen destruction [7]. The process of demineralisation is almost twice as rapid on the root surface as compared to enamel as root cementum contains less mineral content (65%) compared to enamel (96%) [8].

*S. mutans* and *Lactobacillus* were thought to be associated with the initiation and progression of root caries [9]. However, there is no reliable evidence that suggests that *S. mutans* initiates or causes the progression of root caries lesions [10]. Some studies also suggest Actinomyces species to be the main cause of root caries while other studies emphasise root caries to be caused by polymicrobial entities [11,12].

Root caries is associated with several predisposing factors with gingival recession being a prerequisite [5]. Others include poor oral hygiene, xerostomia, coronal decay, abfraction lesions, and the number of exposed root surfaces [13]. In addition, tobacco use and alcohol consumption were also associated with root caries [14]. Frequent intake of carbohydrates, low fluoride exposure, increasing

age, low socioeconomic status, and decreased manual dexterity are also related to the development of root caries [2].

Root surface caries is seen in both adults and elderly populations but is more prevalent in the older age group [4,15]. It is more common in males compared to females [16]. Also, mandibular molars, being the first permanent teeth to erupt and exposed to the oral environment for the longest time period are most likely to be affected with root caries whereas mandibular anteriors were least likely to be affected [17].

Although patients with root caries complain of tooth sensitivity, pain, and diminished ability to chew, tooth loss is the most serious complication from root caries [18]. However, lack of symptoms is one of the major causes for patients not seeking treatment.

Early diagnosis is important since preventive treatment of primary root caries has a better long-term prognosis than restorative treatment. Consequently, a study of the prevalence of root caries will help to determine the availability and accessibility to oral disease prevention and control programs and help improve patient's quality of life.

Thus, the aim of the present study was to determine the prevalence of root caries and the associated risk factors among the South Canara patient.

## 2. MATERIALS AND METHODS

This study was conducted on 2000 patients over a period of one month from May 15, 2018, to June 15 2018, of which 1122 were examined at the out-patient section of Department of Conservative Dentistry and Endodontics and 878 were examined in 5 Rural Health Centres of A.B. Shetty Memorial Institute of Dental Sciences, Nitte University, Deralakatte, Mangaluru. Permission to conduct the study was sought from the relevant authorities. Informed consents were obtained. Failure to consent did not affect patient's treatment and confidentiality of the information given was assured. Patients were examined for root caries after proper isolation of the teeth. A questionnaire was used to gather information on the patient's general information, medical history, and oral hygiene habits. The

assessment consisted of a visual examination using a standard mouth mirror, a sharp-ended explorer, and supplementary lighting from a dental operatory lamp. Patient age, sex, the location of examination, existing oral habits and oral hygiene practices were recorded. Patients were selected on the basis of inclusion and exclusion criteria. Data were recorded on prepared survey form based on the WHO Oral Health Assessment Form 2013 [Annexure 1] [19]. Inclusion and Exclusion criteria were developed.

**2.1 Inclusion Criteria**

- Age group:15-30 years  
31-45 years  
46-60 years  
>60 yrs

**2.2 Exclusion Criteria**

- Edentulous patient
- Patient undergoing orthodontic treatment.
- Patients who were unable to complete the questionnaire

**2.3 Questionnaire**

**Name:**  
**Age group:** 1. 15-30 years 2. 30-45years 3. 45-60 years 4. >60 years  
**Gender:** 1. Male 2. Female  
**Location:** 1. Urban 2. Periurban 3. Rural  
**Diet type:** 1. Vegetarian 2. Non-vegetarian 3. Pescatarian  
**Time of sugar intake:** 1.With meal 2.In between meal  
**Frequency of brushing/day:** 1. Occasionally 2. Once daily 3. Twice daily  
**Brushing Duration:** 1. ≥2 mins 2. ≤ 2 mins  
**Tooth brush Bristle type:** 1. Soft 2. Medium 3. Hard  
**Type of toothpaste:** 1. Fluoridated 2. Non-fluoridated  
 Use of oral hygiene aids 1. Floss 2. Other interdental aid 3. Mouth rinse 4. None.

**Presence of root caries:**

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

**3. RESULTS (Table 1)**

Of the 2000 patients examined 1100 (55%) were male and 900 (45%) were female, while 430

subjects were from urban areas, 692 from periurban areas and 878 were from rural areas.

The prevalence of root caries was noted to be 7.4% (148 out of 2000 subjects).

4.05% of individuals presented with root caries among 15-30 years of the age group, 10.81% in 31-45 years group, and 28.38% in 46-60 group. At 56.76% patients over 60 years old had the highest prevalence of root caries. Root caries was observed more among males (63.51%) compared to females (36.49%). Urban populations showed prevalence of 13.51% root caries, periurban 24.32% and in the rural population, root caries was highest with the prevalence of 62.16%.

Prevalence of root caries was observed to be more among vegetarians (43.24%) followed by non- vegetarians (33.78%) and least in pescatarians (22.97%). Subjects consuming sugar with meals presented with 37.84% root caries and those eating carbohydrates in between meals had 62.16% root caries.

Subjects who brushed for more than 2 minutes showed 33.78% root caries and less than 2 minutes showed 66.72% root caries. Also participants who used soft bristle brush had 12.16% root caries, those employing medium bristle brushes had 28.38% root caries and using a hard bristle brush presented with the highest prevalence of root caries (59.46%). Root caries was more prevalent among those using non-fluoridated toothpaste(66.22%) as compared to those using fluoridated toothpaste(33.72%). Subjects using floss as an adjunct presented with 16.22% root caries, mouthwash 10.80%, other inter-dental aids 6.76% and none had 66.22% root caries. Root caries was more prevalent in patients who were not using any other oral hygiene aids (66.22%).

Root caries was seen to be more prevalent in molar teeth. Incisor teeth showed a prevalence of 22.97% root caries, canines 5.41%, premolars 18.91% and molars 54.71%. Maxillary teeth showed a prevalence of 32.43% root caries whereas 67.57% teeth were affected in the mandibular arch.

**4. DISCUSSION**

Root caries significantly influences the oral health in the elderly population throughout the world [1]. It not only affects the quality of life but

**Table 1. Association between the study variables and presence of root caries**

		Presence of root caries		Total	Chi square test	
		Present	Absent		Chi Square value	p-value
Gender	Male	94 8.5%	1006 91.5%	1100 100.0%	4.68	0.03*
	Female	54 6.0%	846 94.0%	900 100.0%		
Age group (in years)	15-30	6 1.6%	370 98.4%	376 100.0%	262.68	<0.001*
	30-45	16 2.1%	734 97.9%	750 100.0%		
	45-60	42 7.0%	556 93.0%	598 100.0%		
	Above 60	84 30.4%	192 69.6%	276 100.0%		
Location	Urban	20 4.7%	410 95.3%	430 100.0%	21.76	<0.001*
	Periurban	36 5.2%	656 94.8%	692 100.0%		
	Rural	92 10.5%	786 89.5%	878 100.0%		
Diet type	Vegetarians	64 10.9%	522 89.1%	586 100.0%	86.50	<0.001*
	Non-vegetarians	50 3.9%	1218 96.1%	1268 100.0%		
	Pescatarians	34 23.3%	112 76.7%	146 100.0%		
Time of sugar intake	With meal	56 5.5%	968 94.5%	1024 100.0%	11.42	0.001*
	In between meal	92 9.4%	884 90.6%	976 100.0%		
Bristle type	Soft bristle	18 1.8%	974 98.2%	992 100.0%	556.31	<0.001*
	Medium bristle	42 5.0%	800 95.0%	842 100.0%		
	Hard bristle	88 53.0%	78 47.0%	166 100.0%		
Brushing duration	More than 2 minutes	50 4.3%	1112 95.7%	1162 100.0%	38.82	<0.001*
	Less than 2 minutes	98 11.7%	740 88.3%	838 100.0%		
Type of toothpaste	Fluoridated	50 3.3%	1468 96.7%	1518 100.0%	154.99	<0.001*
	Non-fluoridated	98 20.3%	384 79.7%	482 100.0%		
Oral hygiene aids	No other oral hygiene aids	24 12.2%	172 87.8%	196 100.0%	12.80	0.005*
	Mouthwash	10 9.8%	92 90.2%	102 100.0%		
	Floss	16 10.8%	132 89.2%	148 100.0%		
	Other interdental aids	98 6.3%	1456 93.7%	1554 100.0%		

\* $p < 0.05$  statistically significant,  $p > 0.05$  Non Significant, NS

		Frequency	Percentage
Tooth affected	Incisor	34	23.6%
	Canine	4	2.8%
	Premolar	28	19.4%
	Molar	78	54.2%
Jaw affected	Maxilla	44	30.6%
	Mandible	100	69.4%
			100

tooth loss is the final outcome [18]. Most commonly root caries results from gingival recession but other predisposing factors such as abrasion, erosion, and abstraction also contribute to its aetiology. Recession can be attributed to advancing age, oral hygiene practices, plaque accumulation, malocclusion, hormonal changes and certain oral habits [20]. The active root caries lesion is seen as a well defined, softened, yellowish or light brown discolouration usually covered by plaque, some progressing lesions present with a brownish to blackish leathery consistency. On the other hand, inactive lesions are usually not covered by plaque and present as yellowish to brownish black, shiny, smooth lesions and to be hard on probing [21]. Radiographs and special dyes (Fluorescent dye and Diazonium dye) can also be used as an adjunct for diagnosing root caries [22]. Adequate preventive measures such as plaque removal as well as educating patients, maintaining proper oral hygiene practices, regular oral health check-up and diet modification will reduce the risk of developing root caries. Use of topical fluoride in caries susceptible individuals is advised as it promotes remineralisation. Such fluoride exposure can be through fluoridated drinking water, topical fluoride in the form of gel, rinse, varnish and use of fluoridated dentifrices [22,23].

Treatment of root caries depends on the site and extent of the lesion, patient's age, socioeconomic status and the patient's aesthetic requirements. Treatment options include remineralisation procedures, surface recontouring, and restoration of the defect. A variety of materials are available for restoration of root caries like glass ionomer cement, resin composite, and amalgam [22]. However, resin-modified glass ionomer cement is considered to be an ideal restorative material in most of the cases because of its fluoride releasing capacity and ability to bond with tooth structure [24].

The prevalence of root caries was found to be more in males 94(63.51%) than females. This result was in contrast to the study conducted by Marilvia in a group of Brazilian adult dental

patients that showed females had more root caries (18.6%) than males (13.4%) [25]. However, a study conducted by Heinrich, Kunzel, and Heinrich showed root caries to be more prevalent among male individuals compared to females [16]. Differences can be attributed to several factors such as oral hygiene practices, diet, general health and also an awareness and consciousness regarding dental health.

As life expectancy has increased so has the need to retain teeth [1]. With advancing age periodontal breakdown takes place leaving root surfaces denuded and in direct contact with the cariogenic environment that ultimately results in dental decay [2]. This fact could be one of the reasons for an increase in the prevalence of root caries in older individuals. The prevalence of root caries in the present survey among patients over 60 years was noted to be the highest among the study groups (56.76%). Similar findings were seen in the study conducted by Fure in Sweden and Jiang et al in China [17,26]. Inability to practice proper oral hygiene due to a decrease in manual dexterity in the elderly population could be another reason for an increasing incidence of root caries in older patients [2]. This study showed an increase in the prevalence of root caries in the rural population compared to the urban and semi-urban populations. A study conducted in 2017 on Dakshina Kannada population by Mithra N Hegde et al. showed a similar result [27]. This can be due to their limited access to oral health care and unawareness regarding oral hygiene practices.

Pescatarians presented with fewer root caries compared to vegetarians and other non-vegetarians as fish is rich in fluoride and proteins that are responsible for reducing caries [2,28].

Patients with the habit of sugar intake in between meals have a high percentage rate of root caries (62.16%). Those that employed hard bristle brush had more root caries as hard bristles can traumatise gingiva and ultimately cause a gingival recession. Once the root surface is exposed, in the presence of cariogenic

environment the process of demineralisation can begin. Groups that showed with irregular brushing habits brushed for less than a 2 min duration, used non-fluoridated toothpaste and did not use any other oral hygiene aids had a higher incidence of root caries [2]. Also, molars were observed to be the most susceptible to root caries most likely because they are the first teeth to erupt and longer be exposed to the oral environment. Similar results were seen in multiple other patient studies conducted by other researchers, [18,29,30].

## 5. CONCLUSION

Our study showed an increase in the prevalence of root caries in males, patients in the older age group (>60 years), and in the rural population. A relationship between dietary habits and oral hygiene practices and the development of root caries was also found to exist. Moreover, it was found that molar teeth are most susceptible to root caries and that the mandibular teeth have a higher incidence of root caries than teeth in the maxilla.

## CONSENT

Informed consents were obtained.

## ETHICAL APPROVAL

Permission to conduct the study was sought from the relevant authorities.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Gati D, Vieira AR. Elderly at greater risk for root caries: A look at the multifactorial risks with emphasis on genetics susceptibility. *Int J Dent*. 2011;647168.
2. Bignozzi I, Crea A, Capri D, Littarru C, Lajolo CA, Tatakis DN. Root caries: A periodontal perspective. *Journal of Periodontal Research*. 2014;49(2):143-63.
3. Curzon ME, Preston AJ. Risk groups: Nursing bottle caries/caries in the elderly. *Caries research*. 2004;38(Suppl. 1):24-33.
4. Hayes M, Burke F, Allen PF. Incidence, prevalence and global distribution of root caries. In *Root Caries: From Prevalence to Therapy*. 2017;26:1-8. Karger Publishers.
5. Thomson WM. Root surface caries--an overview of aetiology, prevalence, prevention, and management. *The New Zealand Dental Journal*. 1990;86(383):4-9.
6. Pretty IA, Ellwood RP. The caries continuum: Opportunities to detect, treat and monitor the re-mineralization of early caries lesions. *J Dent*. 2013;41(Suppl 2): S12-21.
7. Takahashi N, Nyvad B. Ecological hypothesis of dentin and root caries. *Caries Research*. 2016;50(4):422-31.
8. Shahmoradi M, Bertassoni LE, Elfallah HM, Swain M. Fundamental structure and properties of enamel, dentin and cementum, In: Ben-Nissan, B., Ed., *Advances in calcium phosphate biomaterials*. Vol. 2, 2014 (pp. 511-547). Springer, Berlin, Heidelberg
9. Aparna A, Hegde MN, Shetty V. Evaluation of microflora of root carious lesions in different age groups: A microbiological study. *European Journal of General Dentistry*. 2013;2(2):130.
10. Ellen RP, Banting DW, Fillery ED. *Streptococcus mutans* and *Lactobacillus* detection in the assessment of dental root surface caries risk. *Journal of dental research*. 1985;64(10):1245-9.
11. Brailsford SR, Tregaskis RB, Leftwich HS, Beighton D. The predominant *Actinomyces* spp. isolated from infected dentin of active root caries lesions. *Journal of dental research*. 1999;78(9):1525-34.
12. Sansone C, Van Houte J, Joshipura K, Kent R, Margolis HC. The association of mutans streptococci and non-mutans streptococci capable of acidogenesis at a low pH with dental caries on enamel and root surfaces. *Journal of dental research*. 1993;72(2):508-16.
13. Hayes M, Da Mata C, Cole M, McKenna G, Burke F, Allen PF. Risk indicators associated with root caries in independently living older adults. *J Dent*. 2016;51:8-14.
14. Christensen LB, Bardow A, Ekstrand K, Fiehn NE, Heitmann BL, Qvist V, Twetman S. Root caries, root surface restorations and lifestyle factors in adult Danes. *Acta Odontologica Scandinavica*. 2015;73(6): 467-73.
15. Griffin SO, Griffin PM, Swann JL, Zlobin N. Estimating rates of new root caries in older

- adults. Journal of Dental Research. 2004;83(8):634-8.
16. Heinrich R, Kunzel W, Heinrich J. Prevalence of root caries in a healthy adult population. Deutsche Zahnärztliche Zeitschrift. 1990;45(6):363-6.
  17. Fure S, Zickert I. Prevalence of root surface caries in 55, 65, and 75-year-old Swedish individuals. Community Dentistry and Oral Epidemiology. 1990;18(2):100-5.
  18. Kumara-Raja B, Radha G. Prevalence of root caries among elders living in residential homes of Bengaluru city, India. Journal of clinical and experimental dentistry. 2016;8(3):e260.
  19. World Health Organization. Oral Health Assessment form for Adults; 2013. Annexure 1.
  20. Mythri S, Arunkumar SM, Hegde S, Rajesh SK, Munaz M, Ashwin D. Etiology and occurrence of gingival recession-an epidemiological study. Journal of Indian Society of Periodontology. 2015;19(6): 671.
  21. Fejerskov O, Kidd E, Nyvad B, Baelum V. editor. Dental caries: The disease and its clinical management. 2<sup>nd</sup> ed. Oxford; Blackwell Munksgaard; 2008.
  22. Gupta B, Marya CM, Juneja V, Dahiya V. Root caries: An aging problem. Internet J Dent Sci. 2007;5(1):1-5.
  23. Cai J, Palamara JE, Manton DJ, Burrow MF. Status and progress of treatment methods for root caries in the last decade: A literature review. Aust Dent J. 2018; 63(1):34-54.
  24. Brackett MG, Ryan JM, Haddock FJ, Romero MF, Brackett WW. Use of a modified matrix band technique to restore subgingival root caries. Operative Dentistry; 2018.
  25. Watanabe MG. Root caries prevalence in a group of Brazilian adult dental patients. Braz Dent J. 2003;14(3):153-6.
  26. M Du, Jiang H, Tai B, Zhou Y, Wu B, Bian Z. Root caries patterns and risk factors of middle-aged and elderly people in China. Community Dent Oral Epidemiol. 2009; 37(3):260-6.
  27. Hegde MN, Bhat G, Sadananda V. Root surface caries prevalence in Dakshina Kannada population. International Journal of Innovative Research and Advanced Studies. 2017;4(2).
  28. Hegde MN, Nireeksha. Prevalence of tooth wear due to dietary factors in South Canara population. British Journal of Medicine and Medical Research. 2015; 9(3).
  29. Fejerskov O, Luan WM, Nyvad B, Budtz-Jørgensen E, Holm-Pedersen P. Active and inactive root surface caries lesions in a selected group of 60-to 80-year-old Danes. Caries Research. 1991;25(5):385-91.
  30. Gustavsen F, Clive JM, Tveit AB. Root caries prevalence in a Norwegian adult dental patient population. Gerodontics. 1988;4(5):219-23.

© 2018 Hegde et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:  
<http://www.sciencedomain.org/review-history/27539>*