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REVIEW ARTICLE

Global and regional estimates of the prevalence of root caries – Systematic review and meta-analysis

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KEYWORDS

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Abstract *Aim:* To evaluate the pooled prevalence of root caries through a systematic review and meta-analysis.

Methods: A keyword search was done in Scopus, Pubmed and CINAHL databases using all the synonyms of root caries in the published literature (till January 1st, 2018). The search was supplemented with standard Boolean operators and other keywords like prevalence, epidemiology in the title, abstract and MeSH terms. Data was extracted and exported to Covidence software for screening and removal of duplicates.

Results: The search revealed a total of 492 documents from Scopus (n = 95), Pubmed (n = 220) and CINAHL (n = 177). Random effects model was used as there was a high degree of heterogeneity was seen among the studies published (I^2 = 99.62%). A total of 74 publications were included in the analysis of the pooled prevalence of root caries which yielded a prevalence of 41.5 (36.9–46.1).

Conclusion: Root caries is a significant problem, and four out of ten adults might be affected.

Contents

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1. Introduction

"Root caries" or "Root decay" or "Cemental decay" can be defined as "decay on the root of the tooth" (Banting et al., 1980). Many authors have reported an increased prevalence of root caries due to the longevity of life and dentition (Curzon and Preston, 2004; Lamster et al., 2016; Takahashi and Nyvad, 2016). Previously, it was thought that recession was imperative for the initiation of root caries until Stamm et al. reported that 10–20% of root carious lesions might present subgingivally (Stamm et al., 1990).

Presence of a cariogenic biofilm and fermentable carbohydrates is one of the etiological factors (Ravald et al., 1986). The process of demineralization is similar to coronal caries, but it is twice as rapid on root surfaces as on enamel (Burgess and Gallo, 2002; Featherstone, 1994). Like coronal caries, unfavorable balance on the remineralization would lead to demineralization of root surface.

The prevalence of root caries is usually higher in older adults due to increased tooth retention and exposed root surfaces (Kassebaum et al., 2015). Many studies reported almost half of the participants with root caries experience (Warren et al., 2000; Splieth et al., 2004; Imazato et al., 2006) and still higher levels of root caries in institutionalized elders. Kassebaum et al., 2015 in a systemic review of the burden of dental caries identified three peaks of caries activity and related the peak of 70 years to root caries. Ritter et al., 2010 in their systematic review of risk models of root caries risk indicators identified that the prevalence of root caries at baseline, number of retained teeth and plaque index are the more frequent indicators. Tan and Lo (2014) reported the presence of biofilm, recession and proximity to dentures as site level risk indicators for root caries. Hayes et al. (2016) reported that tobacco and alcohol usage were associated with root caries in individuals over 45 years of age.

Numerous factors interplay with the initiation and development of root carious lesions like advanced age, (Griffin et al., 2004) medications, co-morbidities like xerostomia, lifestyle factors like tobacco and alcohol consumption, the frequency of carbohydrate consumption, low fluoride exposure, proximity to dentures, limited manual dexterity for plaque control, etc. (Clarkson, 1995).

Studies on the prevalence of root caries and risk factors have been reported in the literature widely. Systematic reviews on caries among children, (Al Agili, 2013; Al Ayyan et al., 2018) root caries risk indicators, (Ritter et al., 2010) non-invasive treatment of root caries, (Wierichs and Meyer-Lueckel, 2015) and interventions for managing root caries (Tan et al., 2017) have also been reported. However, there was no data on the pooled prevalence of root caries. Hence, we aimed to evaluate the prevalence estimates of root caries in adults and to evaluate gender and geographic variations.

2. Materials and methods

2.1. Selection criteria

Studies included were of a cohort or a cross-sectional observational design, where prevalence data can be extracted or calculated, and those in which adults above 18 years of age were included. The articles published in English language were included exclusively.

Studies designed as a cohort or cross-sectional observational studies, studies where prevalence data can be extracted or calculated and studies conducted in adults above 18 years of age were included. Conference proceedings, editorials, and letters were excluded. Only articles published in the English language were included.

2.2. Search strategy

A comprehensive search was done in three databases (Pubmed, Scopus, and CINAHL) up to January 1st, 2018. The keywords used in the search strategy were "Root caries" OR "Root Decay" OR "Cementum decay" AND "Prevalence" OR "Cross-sectional studies" OR "Epidemiology" OR "Epidemiologic methods" OR "Epidemiologic research design" OR "Epidemiologic studies" OR "Epidemiologic measurements" OR "Cohort studies", AND "Adults over 18 years of age".

The studies from these three databases were imported to Covidence website (https://www.covidence.org/home) for the removal of duplicate titles. Two authors screened the title and abstracts independently (PKC and HS). Selected articles were subjected to full-text screening by two reviewers independently (PKC and YSK).

2.3. The risk of bias assessment

Appraisal of the articles was done using the risk of bias assessment tool for prevalence studies (Table 1) (Hoy et al., 2012). The risk of bias assessment was done by two reviewers independently (YS and HS) and disagreements were resolved by a third reviewer (PKC).

2.4. Data extraction

A specially designed data extraction form was used to extract information from each study that was included by two reviewers independently (YS and PKC), and disagreements were resolved by a third reviewer (HS). Information included were geographic distribution, criteria used for the assessment

Table 1 Risk of bias assessment checklist for prevalence studies.

Risk of bias items	Category	Score
1. Was the study's target population a close representation of the national population in relation to relevant variables, e.g. age, sex, occupation?	Yes (LOW RISK): The study's target population was a close representation of the national population. No (HIGH RISK): The study's target population was clearly NOT representative of the national population.	0 1
2. Was the sampling frame a true or close representation of the target population?	Yes (LOW RISK): The sampling frame was a true or close representation of the target population. No (HIGH RISK): The sampling frame was NOT a true or close representation of the target population.	0 1
3. Was some form of random selection used to select the sample, OR, was a census undertaken?	Yes (LOW RISK): A census was undertaken, OR, some form of random selection was used to select the sample (e.g. simple random sampling, stratified random sampling, cluster sampling, systematic sampling). No (HIGH RISK): A census was NOT undertaken, AND some form of random selection was NOT used to select the sample.	0 1
4. Was the likelihood of non-response bias minimal?	Yes (LOW RISK): The response rate for the study was $\geq$ 75%, OR, an analysis was performed that showed no significant difference in relevant demographic characteristics between responders and non- responders No (HIGH RISK): The response rate was $<$ 75%, and if any analysis comparing responders and non-responders was done, it showed a significant difference in relevant demographic characteristics between responders and non-responders	0 1
5. Were data collected directly from the subjects (as opposed to a proxy)?	Yes (LOW RISK): All data were collected directly from the subjects. No (HIGH RISK): In some instances, data were collected from a proxy.	0 1
6. Was an acceptable case definition used in the study?	Yes (LOW RISK): An acceptable case definition was used. No (HIGH RISK): An acceptable case definition was NOT used	0 1
7. Was the study instrument that measured the parameter of interest shown to have reliability and validity (if necessary)?	Yes (LOW RISK): The study instrument had been shown to have reliability and validity (if this was necessary), e.g. test-re- test, piloting, validation in a previous study, etc. No (HIGH RISK): The study instrument had NOT been shown to have reliability or validity (if this was necessary).	0 1
8. Was the same mode of data collection used for all subjects?	Yes (LOW RISK): The same mode of data collection was used for all subjects. No (HIGH RISK): The same mode of data collection was NOT used for all subjects.	0 1
9. Were the numerator(s) and denominator(s) for the parameter of interest appropriate	Yes (LOW RISK): The paper presented appropriate numerator(s) AND denominator(s) for the parameter of interest (e.g. the prevalence of low back pain). No (HIGH RISK): The paper did present numerator(s) AND denominator(s) for the parameter of interest but one or more of these were inappropriate.	0 1
Total	Risk categories = Low (0–3), Moderate (4–6); High (7–9)	

of root caries, age group and prevalence estimates as per gender.

2.5. Statistical analysis

Heterogeneity of the studies was assessed using I^2 statistic which evaluates the variation other than that of sampling error. A level of more than 75% indicates a high degree of heterogeneity. Meta-analysis was undertaken using Open Meta software (Metafor Package 1.4) (Wallace et al.,2012). Pooled prevalence with 95% confidence intervals was reported by using the random effects model (DerSimonian and Laird, 1986). Pooled prevalence for various subgroups was also reported. The possibility of publication bias was assessed by funnel plot with the inverse of standard error on Y axis and proportion on the X-axis (Sterne and Egger, 2001).

3. Results

3.1. Search results

Our search resulted in 492 publications from the three databases. A total of 427 articles were included in the title and abstract screening after the removal of duplicates (n = 65). Articles were assessed for eligibility in full-text screening and irrelevant publications were excluded (n = 297). Further, 45 articles were excluded due to inappropriate study design/missing outcome (n = 40), review (n = 2), duplicate study (n = 1), wrong study population (n = 2) and 85 publications were included in the qualitative synthesis. Eleven studies were later excluded (secondary data analysis), and only 74 studies were included in the final meta-analysis (Fig. 1).

3.2. Prevalence

The prevalence of root caries in adults ranged from 3.69 to 96.47% (Christensen et al., 2015; Islas-Granillo et al., 2012) more than 1/3rd of the studies (n = 27), prevalence was above 50% (Banting et al., 1980; Beighton et al., 1991; Fairhall et al., 2009; Ferro et al., 2008; Fure and Zickert, 1990; Guivante-Nabet et al., 1998; Hayes et al., 2016; Hellyer et al., 1990; Hix and O'Leary, 1976; Islas-Granillo et al., 2012; Keltjens et al., 1988; Kularatne and Ekanayake, 2007; Locker and Leake, 1993; Lundgren et al., 1996; Morse et al., 2002; Newell, 2002; Salonen et al., 1989; Saunders and Handelman, 1991; Silva et al., 2014; Simons et al., 2001; Steele et al., 1997; Tan and Lo, 2014; Vilstrup et al., 2007; Wallace et al., 1988; Watanabe, 2003; Wyatt, 2002). A total

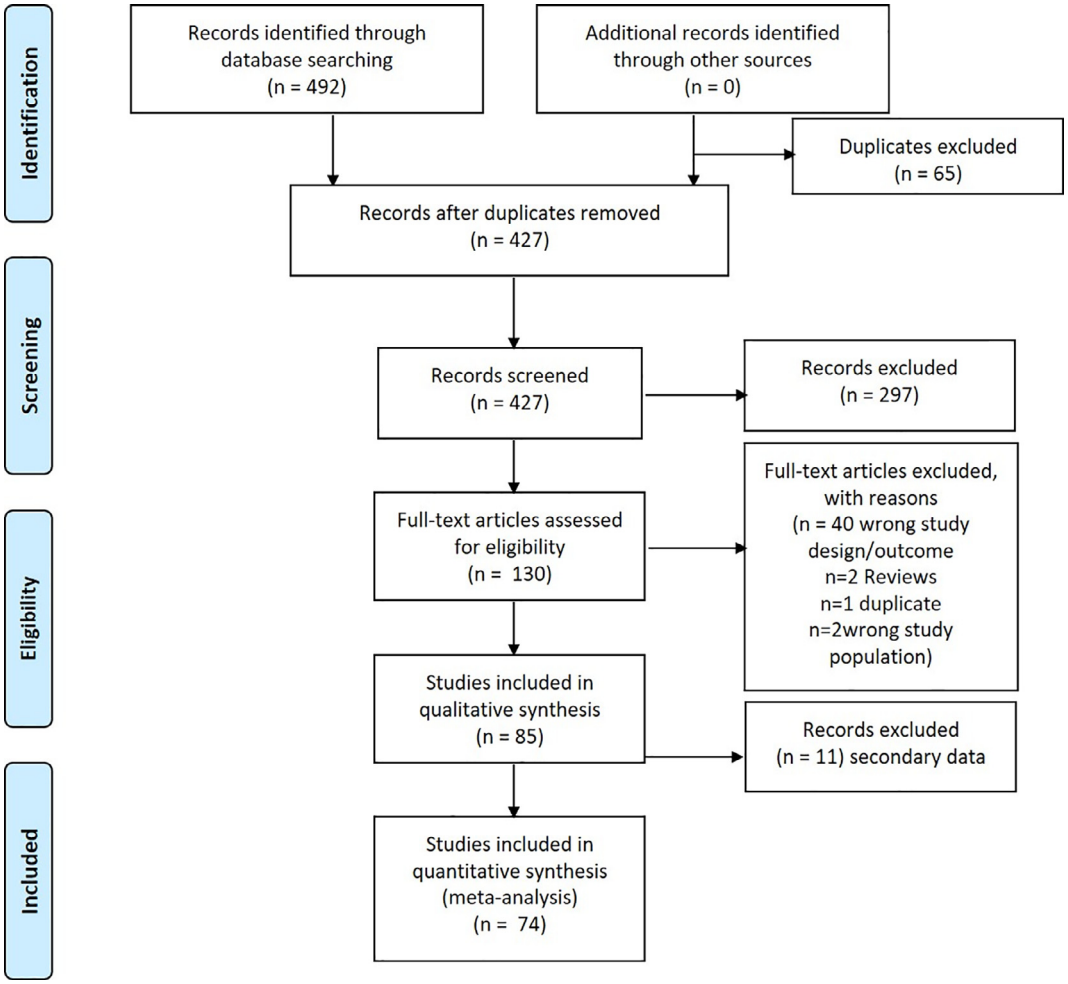

Fig. 1 PRISMA flow chart.

of 17 (23%) publications reported a prevalence of less than 20% (Billings, 1993; Brodeur et al., 2000; Burt et al., 1986; Chi et al., 2013; Christensen et al., 2015; Fadel et al., 2011; Heft and Gilbert, 1991; Kim et al., 2012; Lo and Schwarz, 1994; Lohse et al., 1977; Milstein and Rudolph, 2000; Moore et al., 2001; Nicolau et al., 2000; Ploysangngam et al., 2008; Tan et al., 2015; Thomson et al., 2013; Vehkalahti et al., 1983) and only one study (1.35%) reported a prevalence of less than 5% (Christensen et al., 2015).

3.3. Age

Among the studies included, age didn't overlap precisely. Due to this reason, it was impractical to calculate and present age-specific prevalence estimates. Most of the studies didn't mention the age distribution of the subjects, mean ± SD of age and or age distribution of the prevalence of root caries. Twelve studies used the WHO specified age groups 35–44 (7–52.5) and 65–74 years (26–70.49) for reporting prevalence estimates (Brodeur et al., 2000; Du et al., 2009; Fairhall et al., 2009; Gökalp and Doğan, 2012; Hassan and Omar, 2000; Lin et al., 2001; Lo and Schwarz, 1994; Locker et al., 1989; Locker and Leake, 1993; Mamai-Homata et al., 2012; Rihs et al., 2008; Ringelberg et al., 1996) (Fig. 2). Also, six studies have reported prevalence estimates with overlapping age categories (Lohse et al., 1977; McDermott et al., 1991; Okawa et al., 1993; Salonen et al., 1989; Stamm et al., 1990; Vehkalahti et al., 1983) (Fig. 3).

3.4. Gender

Only 27 studies reported the prevalence of root caries as per the gender. The pooled prevalence among males was 34.5% (95% CI = 28.2–40.9) and females was 33.3% (95% CI = 26.3–40.3) with no statistical difference between them.

3.5. Geographic location

Prevalence figures were summarized as per geographic distribution, and it was seen that very few studies were reported from South America (n = 2; range 20.27–78.06), Africa (n = 3; range = 10.52–43) and Australia (n = 6; range

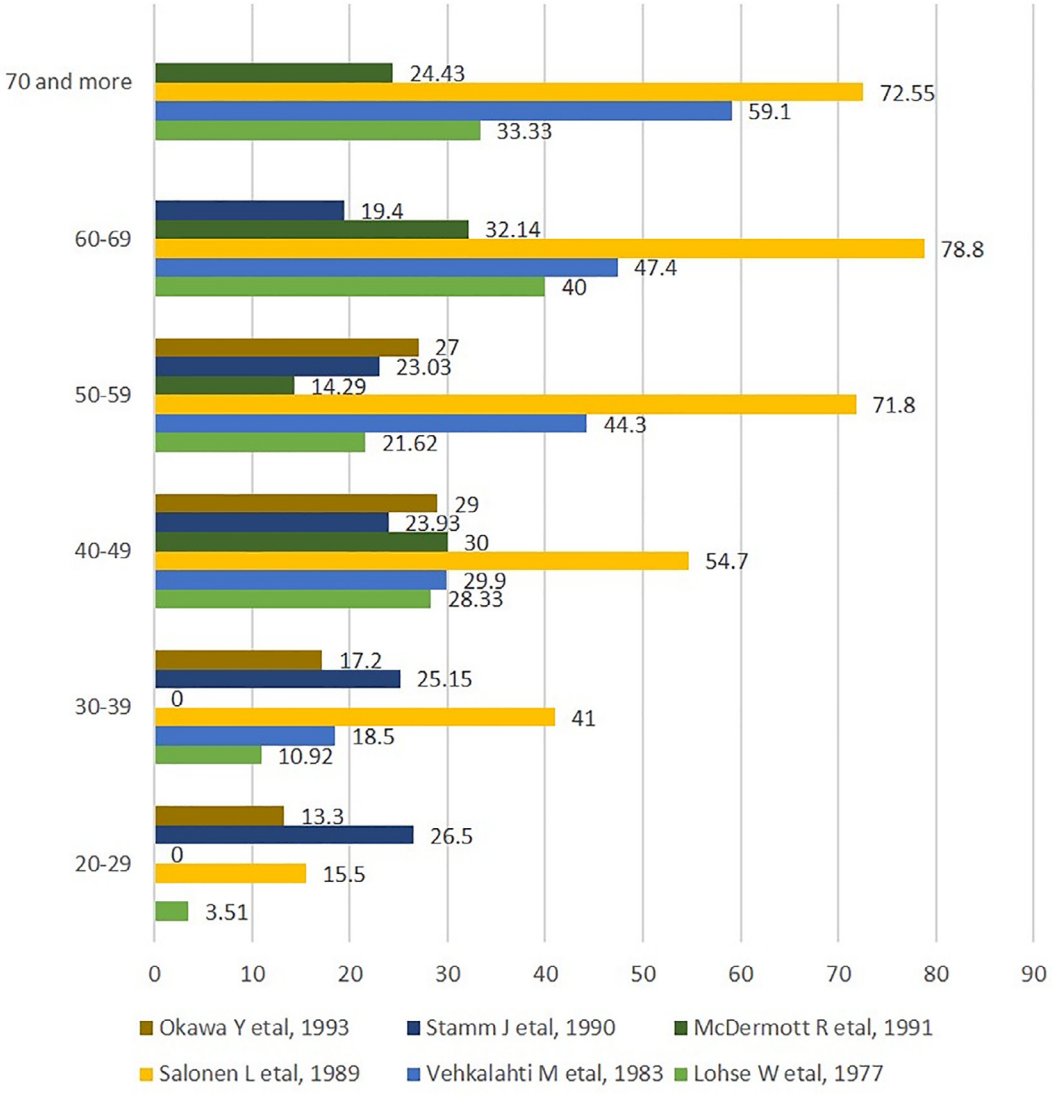

Fig. 2 Prevalence of root caries with respect to age distribution.

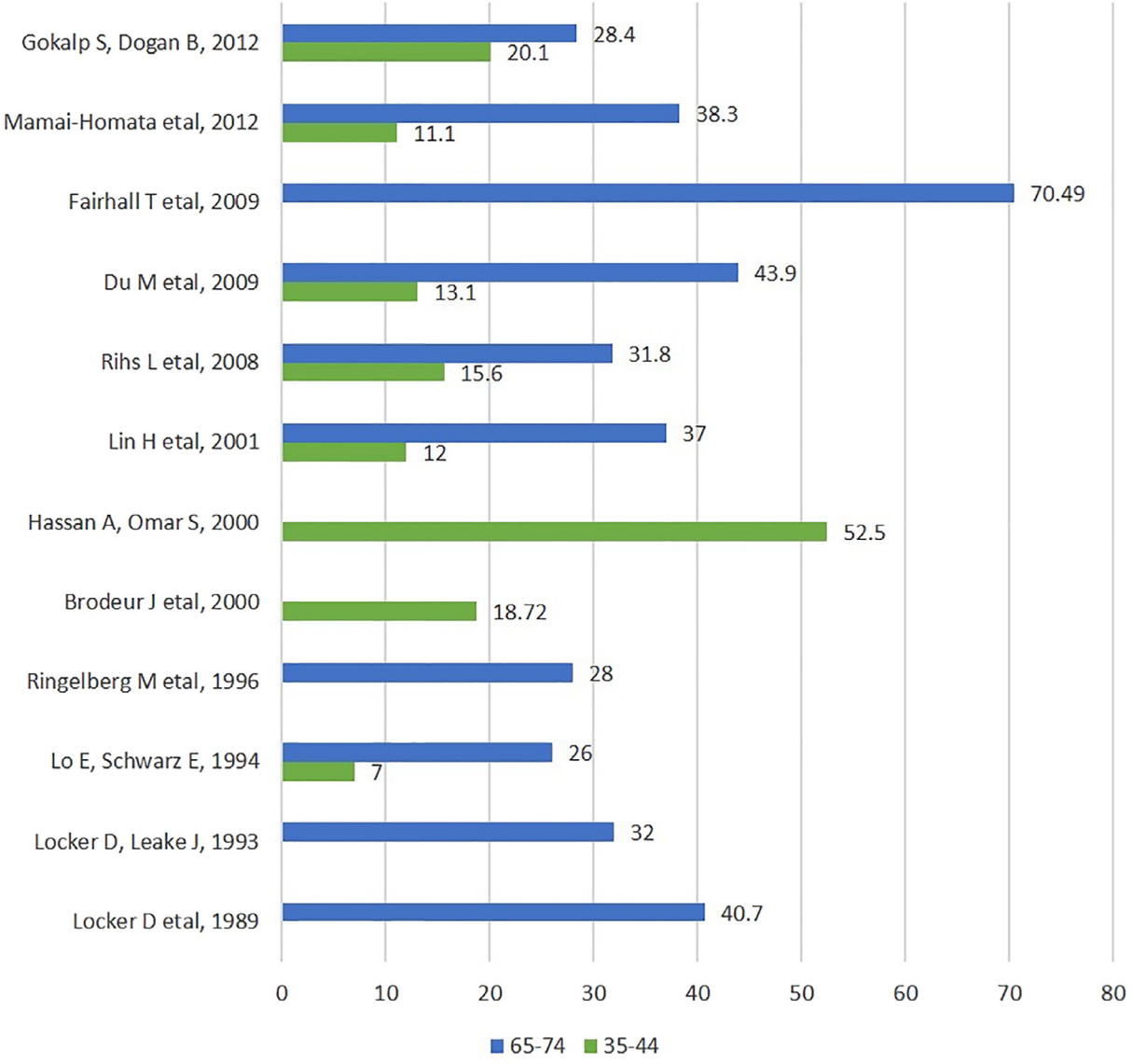

Fig. 3 Prevalence of root caries according WHO age groups.

17.25–77.37). Majority of the studies were from North America (pooled prevalence = 36.8%; n = 27; range = 12.62–96.47) and Europe (pooled prevalence = 50.8%; n = 24; range = 3.68–88.35). A total of 12 studies were reported from Asia (pooled prevalence = 34.6%; range 10.64–89.67).

3.6. Risk of Bias

A total of 31 and 42 studies were in low and moderate risk while only one study was at high risk (Hassan and Omar, 2000). The pooled prevalence figures for low and moderate risk studies were 35.1% (95%CI = 28.4–31.8) and 46.2% (95% CI–39.4–53).

3.7. Meta-analysis

Eleven publications were excluded as they were a secondary analysis of data published earlier. A total of 74 publications were included in the analysis of the pooled prevalence of root caries. High heterogeneity was observed among the studies included as depicted by Q ($Q = 19384.29$; $P < 0.001$; $df = 73$) and I^2 values ($I^2 = 99.6$; $P < 0.001$). The random effects model yielded a pooled prevalence of 41.5 (CI = 36.9–46.1) (Fig. 4). Meta-regression showed no significant difference in the trend of root caries prevalence with study year (Coefficient: −0.001; 95% CI: −0.007–0.004; P-value: 0.654) (Fig. 5).

3.8. Publication bias

The funnel plot showed asymmetry ($p < 0.001$) (Fig. 6).

4. Discussion

Theoretically, root caries is a preventable disease and can be arrested at any stage like coronal caries (Galan and Lynch,

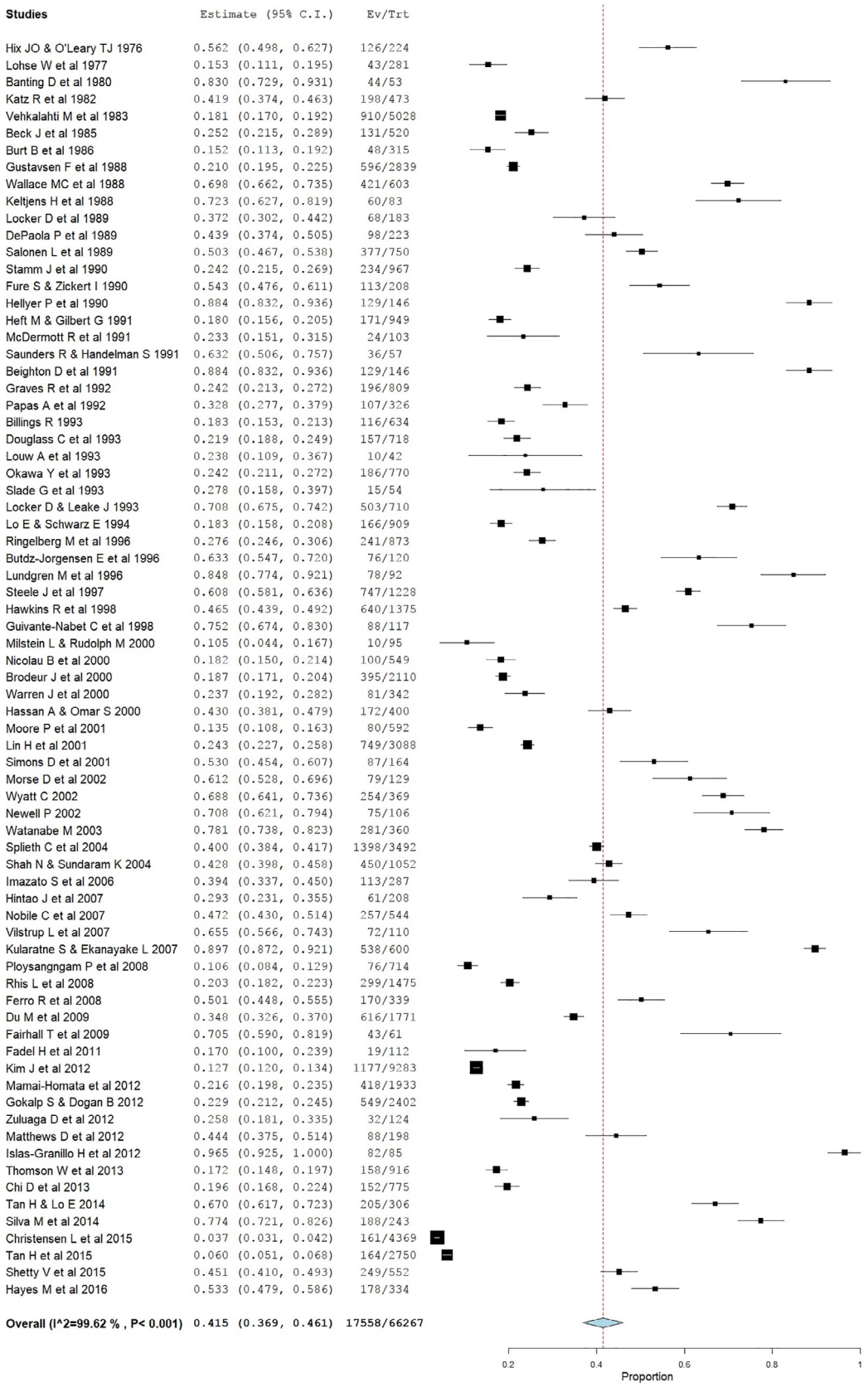

Fig. 4 Forrest plot.

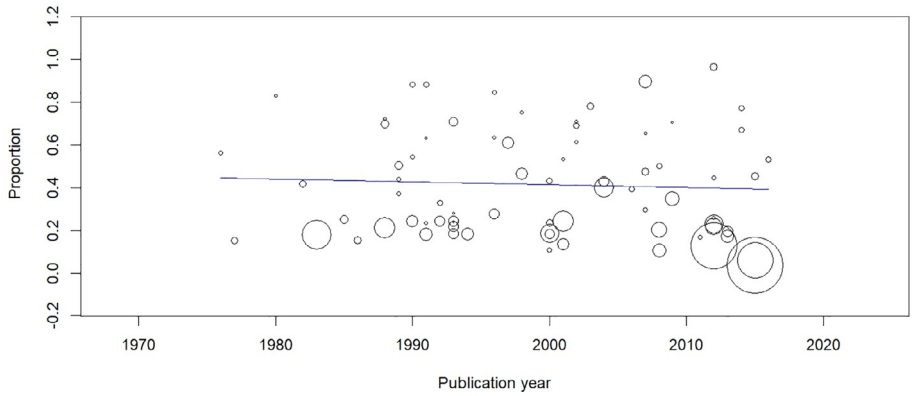

Fig. 5 Meta-regression to evaluate the time effect with year.

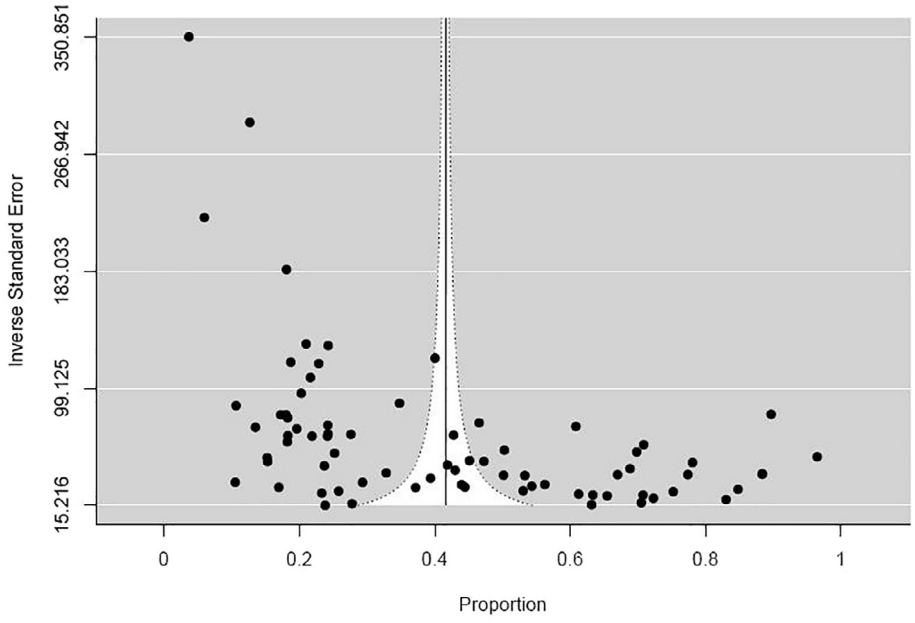

Fig. 6 Bias in prevalence estimates of root caries with inverse standard error.

1994). We aimed to evaluate the pooled estimates of root caries prevalence among adults. Seventy-four prevalence estimates constituted to the pooled prevalence of root caries in this meta-analysis.

Considering the variation and heterogeneity among the included studies, the presented estimates have to be interpreted with caution. High heterogeneity among the studies could be due to the geographical variations or different criteria used to assess the prevalence of root caries. Overall, we can conclude that the prevalence of root caries was 41.5%. Considerable variation existed with respect to the geographic distribution. It was not possible to report the pooled prevalence of South America, Africa, and Australia as there were only a limited number of studies. European studies reported high estimates (50.8%) when compared to studies from North America (36.8%) and Asia (34.6%). Concerning gender, minimal difference in the prevalence estimates was seen between males (34.5%) and females (33.3%). Similarly, no significant difference was seen in the trend of root caries prevalence during these four decades. There was no proper presentation of prevalence according to the age among the included publications.

Studies of root decay are often difficult to compare due to the variations in the measurements and reporting of the prevalence estimates (Locker et al., 1989). In our review, high variation in assessment criteria (13 different criteria) was observed, the most popular being Root caries index, criteria laid down by WHO (1977, 1987 and 1997), NIDR and Banting et al. (1980). (Banting et al., 1980; Katz, 1980; WHO, 1997) more than 10% of the studies didn't explicitly specify criteria for diagnosis but reported the prevalence. There was a significant diversity of root caries assessment (cavitation or softening or both) among the included studies. Only 1/3rd of the studies clearly specified the criteria that have been used to diagnose caries. Although there was a variation in the caries assessment criteria, most studies summarized the results in terms of percentage decayed or decayed filled teeth and or root caries index. Only nine studies explicitly stated that they have used only the decayed teeth for the calculation of prevalence of root caries (Table 2).

Table 2 Summary characterstics of included studies.

Author, Year	Sample	Location	Age	Risk of Bias	Prevalence	Male	Female
Hix and O'Leary (1976)[*]	224	NA	50.8 ± 9.9	M	56.25		
Lohse et al. (1977)[#]	281	NA	> 19	M	15.30		
Banting et al. (1980)[†,*]	53	E	36–89	M	83.02		
Katz et al. (1982)	473	NA	20–64	L	41.86		
Vehkalahti et al. (1983)	5028	E	> 30	L	18.10	21.57	14.47
Beck et al. (1985)	520	NA	> 65	L	25.19	30.05	22.08
Burt et al. (1986)	315	NA	27–65	L	15.24		
Gustavsen et al. (1988)	2839	E	> 20	M	20.99		
Wallace et al. (1988)	603	NA	> 60	L	69.82	76.47	65.48
Keltjens et al. (1988)	83	E	22.4–71.5	M	72.29		
Locker et al. (1989)	183	NA	> 50	L	37.16	44.74	31.78
DePaola et al. (1989)	223	NA	44–64	M	43.95		
Salonen et al. (1989)[*]	750	E	> 19	L	50.27		
Stamm et al. (1990)	967	NA	> 18	M	24.20	24.01	22.62
Fure and Zickert (1990)[*]	208	E	55, 65, 75	L	54.33		
Hellyer et al. (1990)	146	E	> 55	M	88.36		
Heft and Gilbert (1991)	949	NA	65–97	L	18.02		
McDermott et al. (1991)[†,#]	103	NA	22–91	L	23.30	28.07	17.39
Saunders and Handelman (1991)[†]	57	NA	66–93	L	63.16	70.00	61.70
Beighton et al. (1991)	146	E	> 55	M	88.36		
Graves et al. (1992)	809	NA	> 65	L	24.23		
Papas et al. (1992)	326	NA	> 40	M	32.82		
Billings (1993)[#]	634	NA	> 20	M	18.30	22.39	16.40
Douglass et al. (1993)[#]	718	E	> 70	L	21.87	16.36	11.59
Louw et al. (1993)	42	Af	65.2	M	23.81	50.00	7.69
Okawa et al. (1993)	770	As	20–59	L	24.16	25.47	17.92
Slade et al. (1993)[†]	54	Au	60–92	L	27.78		
Locker and Leake (1993)	710	NA	50–90	M	70.85		
Lo and Schwarz (1994)	909	As	35–44&65–74	M	18.26		
Ringelberg et al. (1996)	873	NA	> 45	L	27.61	30.89	25.05
Budtz-Jørgensen et al. (1996)[†]	120	E	69–97	M	63.33		
Lundgren et al. (1996)[*]	92	E	88	M	84.78		
Steele et al. (1997)	1228	E	> 59	M	60.83		
Hawkins et al. (1998)[†]	1375	NA	> 85	M	46.55		
Guivante-Nabet et al. (1998)[†]	117	E	64–102	M	75.21		
Milstein and Rudolph (2000)[†,#]	95	Af		M	10.53		
Nicolau et al. (2000)	549	As	60–74	L	18.21	14.80	20.11
Brodeur et al. (2000)	2110	NA	35–44	L	18.72		
Warren et al. (2000)	342	NA	> 79	M	23.68	32.41	19.66
Hassan and Omar (2000)[*]	400	Af	16–70	H	43.00		
Moore et al. (2001)[†]	592	NA	32.8	M	13.51		
Lin et al. (2001)	3088	As	35–44&65–74	M	24.26		
Simons et al. (2001)	164	E	81.2	L	53.05		
Morse et al. (2002)	129	E	> 80	M	61.24	62.22	60.71
Wyatt (2002)[†]	369	NA		M	68.83	75.00	66.90
Newell (2002)	106	Au	45–64	M	70.75		
Watanabe (2003)	360	SA	35–44 & 50–59	M	78.06	30.63	81.00
Splieth et al. (2004)	3492	E	25–79	L	40.03	41.12	38.93
Shah and Sundaram (2004)	1052	As	> 60	M	42.78		
Imazato et al. (2006)	287	As	60–75	M	39.37		
Hintao et al. (2007)[†]	208	As	54.3 & 53.3	L	29.33		
Nobile et al. (2007)[#]	544	E	> 20	L	47.24		
Vilstrup et al. (2007)	110	E	85	M	65.45	67.39	64.06
Kularatne and Ekanayake (2007)	600	As	> 60	L	89.67		
Ploysangngam et al. (2008)	714	As	> 60	M	10.64	10.64	
Rihs et al. (2008)	1475	SA	35–44 & 65–74	L	20.27		
Ferro et al. (2008)[†]	339	E	46–103	M	50.15		
Du et al. (2009)	1771	As	35–44,65–74	L	34.78	30.40	39.29
Fairhall et al. (2009)	61	Au	66–74	L	70.49		
Fadel et al. (2011)[*]	112	As	38 ± 15	M	16.96		
Kim et al. (2012)[#]	9283	NA	> 20	M	12.68		
Mamai-Homata et al. (2012)	1933	E	35–44&65–74	L	21.62		
Gökalp and Doğan (2012)	2402	E	35–44 & 65–74	L	22.86	25.76	21.15

(*continued on next page*)

Table 2 (*continued*)

Author, Year	Sample	Location	Age	Risk of Bias	Prevalence	Male	Female
Zuluaga et al. (2012)[†]	124	E	85.7	M	25.81		
Matthews et al. (2012)[†]	198	NA	≥45	M	44.44		
Islas-Granillo et al. (2012)	85	NA	>60	M	96.47		
Thomson et al. (2013)	916	Au	38	M	17.25	19.57	14.47
Chi et al. (2013)[#]	775	NA	45–97	M	19.61	18.69	20.85
Tan and Lo (2014)	306	As	78.8	M	66.99		
Silva et al. (2014)[†]	243	Au	46–102	L	77.37		
Christensen et al. (2015)	4369	E	21–89	L	3.69	4.42	3.22
Tan et al. (2015)	2750	Au	>14	L	5.96		
Shetty et al. (2015)[†,#]	552	NA	>18	M	45.11	43.05	53.77
Hayes et al. (2016)	334	E	69.1	M	53.29	50.68	55.38

SA: South America; NA: North America; Af: Africa; As: Asia; Au: Australia; L: Low; M: Moderate; H: High.
[*] Radiographs used for diagnosis.
[#] Only decayed teeth was considered for prevalence.
[†] Co-morbidity.

Moreover, estimates in few studies were presented in relation to subjects, teeth, or surfaces. Significant efforts were made by Katz and formulated root caries index in which only lesions and restorations on root surfaces affected by the recession were to be counted (Katz, 1980). There is diversity in this convention and numerous modifications have been used. Some authors excluded root restorations and decay adjacent to restorations or crowns (Vehkalahti et al., 1983) while others have examined all teeth for root caries and root surface restorations irrespective of gingival recession (Burt et al., 1986).

High-quality prevalence studies are required, and emphasis should be on the presentation of prevalence estimates concerning age and gender. More than 2/3rd of the studies have not reported the prevalence figures in regard to gender. Emphasis should be given while reporting the prevalence figures for decayed teeth and decayed and filled teeth as these need to be reported independently. Also, care should be exercised when calculating the prevalence to include subjects with and without recession. As root caries is the condition in older individuals, there might be concomitant edentulousness which needs to be addressed in calculating the prevalence. Current consensus for the initiation or progression of root caries is to have gingival recession. However, few studies reported that root caries may occur sub-gingivally. Future studies should consider these aspects while reporting the prevalence figures.

Co-morbid conditions are concomitant among the elderly subjects with root caries. Among the included studies, 16 studies had subjects with co-morbidities (Table 2). Only eight studies reported the prevalence estimates separately for subjects with co-morbidities (Range: 16.1–77.37). However, the details of the co-morbid conditions and corresponding prevalence estimates were not specified except for two studies in Diabetic patients (Hintao et al., 2007; Moore et al., 2001).

Majority of the studies included were surveys, where the use of radiographs is not widely acknowledged. Seven studies used radiographs for the diagnosis (Table 2). However, it was suggested that radiographs would be helpful especially in proximal lesions (Banting, 2001). Lack of use of radiographs could have underestimated the prevalence estimates.

Oral health care personnel should be aware of this common problem, and early diagnosis and preventive management to arrest root caries. Exclusion of Non-English publications, high heterogeneity, lack of reporting of estimates with respect to age were some of the limitations of this systematic review. The prevalence estimates may not directly reflect the treatment need. Nevertheless, it would help to understand the burden of disease by policymakers and caregivers.

Future studies on the prevalence of root caries should incorporate the standard guidelines of "Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)" and widely accepted criteria.

5. Conclusion

Root caries is a major problem, and four out of ten adults might be affected. Prevalence estimates might increase in future due to the increase in ageing population and longevity of dentition. Efforts should be made to prioritize preventive care by policy makers and health care professionals to reduce the burden of disease among the elderly.

Ethical statement

This manuscript is a systematic review and meta-analysis. This manuscript does not contain any research findings done on humans or animals.

Search strategy

Pubmed

(((Root Caries[Title/Abstract] OR Root Decay[Title/Abstract] OR Cementum Decay[Title/Abstract])) OR (Root Caries OR Root Decay OR Cementum Decay [MeSH Terms])) AND (Prevalence[Title/Abstract] OR Cross-sectional studies[Title/Abstract] OR Epidemiology[Title/Abstract] OR epidemiologic methods[Title/Abstract] OR epidemiologic research design[Title/Abstract] OR epidemiologic studies[Title/Abstract] OR epidemiologic measurements[Title/Abstract] OR cohort studies[Title/Abstract])

Scopus

TITLE-ABS-KEY (prevalence) OR TITLE-ABS-KEY (cross-sectional AND studies) OR TITLE-ABS-KEY (epidemiology) OR TITLE-ABS-KEY (epidemiologic AND methods) OR TITLE-ABS-KEY (epidemiologic AND research AND design) OR TITLE-ABS-KEY (epidemiologic AND studies) OR TITLE-ABS-KEY (epidemiologic AND measurements) OR TITLE-ABS-KEY (cohort AND studies) AND TITLE-ABS-KEY (root AND caries OR root AND decay OR cementum AND decay)

CINAHL

TX (Root Caries OR Root Decay OR Cementum Decay) AND TX (Prevalence OR Cross-sectional studies OR Epidemiology OR epidemiologic methods OR epidemiologic research design OR epidemiologic studies OR epidemiologic measurements OR cohort studies)

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