Table 1 Search strategy

Database 1: PubMed

(("oral health"[MeSH Terms] OR ("oral"[All Fields] AND "health"[All Fields]) OR "oral health"[All Fields] OR ("periodontal diseases"[MeSH Terms] OR ("periodontal"[All Fields] AND "diseases"[All Fields]) OR "periodontal diseases"[All Fields] OR ("periodontal"[All Fields] AND "disease"[All Fields]) OR "periodontal disease"[All Fields]) OR (("periodontal"[All Fields] OR "periodontally"[All Fields] OR "periodontically"[All Fields] OR "periodontics"[MeSH Terms] OR "periodontics"[All Fields] OR "periodontic"[All Fields] OR "periodontitis"[MeSH Terms] OR "periodontitis"[All Fields] OR "periodontitides"[All Fields]) AND ("health"[MeSH Terms] OR "health"[All Fields] OR "health s"[All Fields] OR "healthful"[All Fields] OR "healthfulness"[All Fields] OR "healths"[All Fields])) OR ("periodontal"[All Fields] OR "periodontally"[All Fields] OR "periodontically"[All Fields] OR "periodontics"[MeSH Terms] OR "periodontics"[All Fields] OR "periodontic"[All Fields] OR "periodontitis"[MeSH Terms] OR "periodontitis"[All Fields] OR "periodontitides"[All Fields]) OR (("ambulatory care facilities"[MeSH Terms] OR ("ambulatory"[All Fields] AND "care"[All Fields] AND "facilities"[All Fields]) OR "ambulatory care facilities"[All Fields] OR "clinic"[All Fields] OR "clinic s"[All Fields] OR "clinical"[All Fields] OR "clinically"[All Fields] OR "clinicals"[All Fields] OR "clinics"[All Fields]) AND ("attach"[All Fields] OR "attachable"[All Fields] OR "attached"[All Fields] OR "attachement"[All Fields] OR "attaches"[All Fields] OR "attaching"[All Fields] OR "attachment"[All Fields] OR "attachments"[All Fields]) AND ("level"[All Fields] OR "levels"[All Fields])) OR ("alveolar bone loss"[MeSH Terms] OR ("alveolar"[All Fields] AND "bone"[All Fields] AND "loss"[All Fields]) OR "alveolar bone loss"[All Fields]) OR (("probe"[All Fields] OR "probe s"[All Fields] OR "probed"[All Fields] OR "probes"[All Fields] OR "probing"[All Fields] OR "probings"[All Fields]) AND ("depth"[All Fields] OR "depths"[All Fields]))) AND ("respiratory tract diseases"[MeSH Terms] OR ("respiratory"[All Fields] AND "tract"[All Fields] AND "diseases"[All Fields]) OR "respiratory tract diseases"[All Fields] OR ("respiratory"[All Fields] AND "disease"[All Fields]) OR "respiratory disease"[All Fields] OR "respiration disorders"[MeSH Terms] OR ("respiration"[All Fields] AND "disorders"[All Fields]) OR "respiration disorders"[All Fields] OR ("respiratory"[All Fields] AND "disease"[All Fields]) OR ("pulmonary disease, chronic obstructive"[MeSH Terms] OR ("pulmonary"[All Fields] AND "disease"[All Fields] AND "chronic"[All Fields] AND "obstructive"[All Fields]) OR "chronic obstructive pulmonary disease"[All Fields] OR ("chronic"[All Fields]

AND "obstructive"[All Fields] AND "pulmonary"[All Fields] AND "disease"[All Fields])) OR (("lung"[MeSH Terms] OR "lung"[All Fields] OR "pulmonary"[All Fields]) AND ("functional"[All Fields] OR "functional s"[All Fields] OR "functionalities"[All Fields] OR "functionality"[All Fields] OR "functionalization"[All Fields] OR "functionalizations"[All Fields] OR "functionalize"[All Fields] OR "functionalized"[All Fields] OR "functionalizes"[All Fields] OR "functionalizing"[All Fields] OR "functionally"[All Fields] OR "functionals"[All Fields] OR "functioned"[All Fields] OR "functioning"[All Fields] OR "functionings"[All Fields] OR "functions"[All Fields] OR "physiology"[MeSH Subheading] OR "physiology"[All Fields] OR "function"[All Fields] OR "physiology"[MeSH Terms])) OR (("airflow"[All Fields] OR "airflows"[All Fields]) AND ("limit"[All Fields] OR "limitation"[All Fields] OR "limitations"[All Fields] OR "limited"[All Fields] OR "limiting"[All Fields] OR "limits"[All Fields]))))) AND (english[Filter])

Database 2: Ovid EMBASE

Sequence	Query
1	((Oral health) OR (periodontal disease) OR (periodontal health) OR (periodontitis) OR (clinical attachment level) OR (alveolar bone loss) OR (probing depth)) AND ((Respiratory disease) OR (chronic obstructive pulmonary disease) OR (pulmonary function) OR (airflow limitation)) {Including Related Terms}
2	limit **1** to (full text and human and english language)
3	limit **1** to english language

Database 3: Ovid Cochrane Central Register of Controlled Trials

Sequence	Query
1	((Oral health) OR (periodontal disease) OR (periodontal health) OR (periodontitis) OR (clinical attachment level) OR (alveolar bone loss) OR (probing depth)) AND ((Respiratory disease) OR (chronic obstructive pulmonary disease) OR (pulmonary function) OR (airflow limitation)) {Including Related Terms}
2	limit **1** to english language

Table 2 Adjustment for confounders of included studies

Study Author	Covariates in logistic regression multivariable model
Hayes *et al*[1]	Age, smoking, education, height
Scannapieco *et al*[2]	Smoking
Garcia *et al*[3]	Age, height, alcohol, education **(with stratified analysis on smoking)**
Leuckfeld *et al*[4]	Age, female gender, **pack years of smoking**
Liu *et al*[5]	Age, gender, BMI and smoking
Wang *et al*[6]	Age, gender, BMI **(with stratified analysis on smoking)**
Si *et al*[7]	Age, gender, occupation, educational level **(with stratified analysis on smoking)**
Zhou *et al*[8]	Age, gender, smoking, BMI, season **(with stratified analysis on smoking)**
Ledić *et al*[9]	Age, gender, **pack years of smoking**, BMI
Lopez-de-Andrés *et al*[10]	Age, gender, smoking, educational level, DM, obesity
Zhou *et al*[11]	Age, gender, smoking, BMI
Kataoka *et al*[12]	Age, smoking
Qian *et al*[13]	Age, sex, education levels, BMI, smoking, drinking, hypertension, DM
Barros *et al*[14]	Age, gender, Race, BMI, education, **pack years of smoking**, hypertension
Scannapieco *et al*[15]	Age, gender, **pack years of smoking**, Race, education, income, dental visits, alcohol, DM
Hyman *et al*[16]	Age, gender, Race, history of hypertension and heart attack, dental visit within 1 year, BMI, family income **(with stratified analysis on smoking)**
Chung *et al*[17]	Age, smoking, family income, education, alcohol, exercise, BMI, tooth brushing frequency, DM, number of natural teeth
Harland *et al*[18]	Age, number of present teeth, BMI, alcohol consumption, occupation, hypertension, DM **(with stratified analysis on smoking)**
Takeuchi *et al*[19]	Age, gender, **pack years of smoking**, occupation, DM, BMI, physical activity, alcohol intake, number of present teeth

Jung *et al*[20]	Age, gender, smoking, educational level, household income, alcohol consumption, periodontal status, number of missing teeth, oral health factors
Winning *et al*[21]	Age, gender, smoking, height, BMI, exercise, DM, hypertension, MI, education level, living condition
AbdelHalim *et al*[22]	Age, BMI, low-level of education, **pack years of smoking**, MRC, CAT, hospitalizations, COPD category (C-D), FVC (% predicted), FEV1 (% predicted), FEV1 / FVC (% predicted), MMEF (% predicted), PEF (% predicted), CRP

BMI, body mass index; CAT, chronic obstructive pulmonary disease assessment test; CRP, C-reactive protein; DM, diabetes mellitus; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; MI, myocardial infarction; MMEF, maximum mid-expiratory flow; MRC, Medical Research Council; PEF, peak expiratory flow.
Bold: the covariate of smoking intensity (duration and dose) or stratified analyses on smoking status.

Table 3 Diagnostic criteria for PD of included studies in quantitative analysis

Study Author	Diagnostic parameter/criteria	Measurement/Calculation
Hayes *et al*[1]	**Worst alveolar bone loss (ABL) quintile vs all others**	Worst ABL quintile had mean whole-mouth ABL scores of 20% or greater, i.e., an average of 20% or more ABL for each mesial and distal site measured.
Scannapieco *et al*[2]	**Simplified oral hygiene index=6**	Calculated by adding together the simplified debris index and the simplified calculus index scores.
Garcia *et al*[3]	**ABL**	Periodontitis measure is mean, whole mouth, radiographic alveolar bone loss used as a continuous variable, with each unit of ABL representing 20% increments of bone loss.
Scannapieco *et al*[15]	**Mean attachment loss (AL)≥ 3mm**	AL was obtained by subtracting the distance from the free gingival margin (FGM) to the cemento-enamel junction (CEJ) of each tooth, from the distance from the FGM to the bottom of the sulcus.
Hyman *et al*[16]	**Mean AL≥4mm**	AL was calculated based on the probe distance in millimeters from the FGM to the CEJ and the base of the sulcus.
Leuckfeld *et al*[4]	**Mean marginal bone level≥ 4mm**	The marginal bone level distance was measured from the CEJ to the alveolar bone crest, at the mesial and distal aspects of approximal tooth sites, and was rounded off to the nearest 0.1mm.
Wang *et al*[6]	**Clinical attachment level (CAL)≥4mm**	Probing depth + CEJ = CAL; probing depth and CEJ were measured with a Williams periodontal probe at six sites of all teeth (excluding third molars) and recorded in millimetres.
Liu *et al*[5]	**CAL>4mm**	Consistent with the study by Wang *et al*[6].
Si *et al*[7]	**Probing depth≥5mm and CAL≥4mm**	The two indices were recorded on six sites of each tooth.
Zhou *et al*[8]	**CAL**	Consistent with the study by Wang *et al*[6].
Barros *et al*[14]	**≥2 interproximal sites with CAL≥6mm (not on same tooth) and≥1 interproximal site with probing depth≥5mm**	Using the consensus definitions published by the joint Center for Disease Control/American Association of Periodontology working group.
Ledić *et al*[9]	**CAL≥4mm at at least 60% of the measured sites**	CAL was determined as the distance from the CEJ to the bottom of the pocket. The aforementioned value

		was recorded on the nearest milimeter by one calibrated examiner on six places per tooth (mesiobuccally, buccally, distobuccally, mesiolingually, lingually and distolingually).
Chung *et al*[17]	**Community periodontal index (CPI) >5.5mm pocket (deep periodontal pocket)**	WHO criteria (Oral health surveys: basic methods-5th edition).
AbdelHalim *et al*[22]	**CAL≥5mm**	Calculations of CAL were done by summation of probing pocket depth (PPD) and recession value. Periodontal examination was performed on all existing teeth (excluding the third molar teeth).
Harland *et al*[18]	**CPI score ≥3 (at least one sextant with a pocket depth ≥4 mm)**	WHO criteria.
Lopez-de-Andrés *et al*[10]	**Teeth bleeding spontaneously or while brushing, or/and teeth moving**	Questionnaire investigation.
Takeuchi *et al*[19]	**Severe periodontitis (2 or more interproximal sites with ≥6mm CAL [not on same tooth] and 1 or more interproximal sites with ≥5mm PPD)**	According to the suggested Centers for Disease Control and American Academy of Periodontology case definitions for periodontitis surveillance.
Jung *et al*[20]	**CPI=3-4 (periodontal pockets ≥4mm)**	The central incisor, first and second molars were selected as index teeth, and the highest score adopted as the participant's final CPI score.
Qian *et al*[13]	**Proportion of remaining bone height of the teeth (calculated from total root length and total bone height)**	Measurements of ABL were made from the CEJ to the tooth apex (total root length) and from the marginal bone crest to the tooth apex (total bone height).
Winning *et al*[21]	**A distance between the alveolar bone level and CEJ based on a threshold of ≥4mm found at ≥30% of teeth.**	The extent of ABL was measured at the mesial and distal aspects of all teeth excluding third molars.
Zhou *et al*[11]	**CAL ≥5mm**	Consistent with the study by Wang *et al*[6]
Kataoka *et al*[12]	**PPD ≥4mm**	The PPD was measured at the disto-, mid-, and mesio-buccal, as well as the disto-, mid-, and mesio-lingual buccal surfaces of all the teeth.

Table 4 Quality assessment based on the Newcastle-Ottawa Scale

(A) Cohort study

Study Author	Selection				Comparability	Outcome			Total score
	Exposed cohort	Nonexposed cohort	Ascertainment of exposure	Outcome of interest		Assessment of outcome	Length of follow-up	Adequacy of follow-up	
Barros *et al*[14]	*	*	*	…	…	*	*	*	6
Takeuchi *et al*[19]	*	*	*	*	…	*	*	*	7
Qian *et al*[13]	…	*	*	…	…	*	*	…	4

(B) Case-control / cross-sectional study

Study Author	Selection				Comparability	Outcome			Total score
	Case definition	Representati--veness of the cases	Control selection	Control definition		Ascertainment of exposure	Same method of ascertainment for cases and controls	Non--response rate	
Hayes *et al*[1]	*	…	*	*	*	*	*	*	7
Scannapieco *et al*[2]	…	*	*	*	…	*	*	…	5
Garcia *et al*[3]	*	…	*	*	*	*	*	*	7
Scannapieco *et al*[15]	…	*	*	*	…	*	*	*	6
Hyman *et al*[16]	*	*	*	*	…	*	*	*	7
Leuckfeld *et al*[4]	*	…	…	*	…	*	*	*	5
Wang *et al*[6]	*	*	…	*	*	*	*	*	7
Liu *et al*[5]	*	*	…	*	*	*	*	*	7
Si *et al*[7]	*	*	…	*	*	*	*	*	7
Zhou *et al*[8]	*	*	…	*	*	*	*	*	7
Ledić *et al*[9]	*	*	…	*	*	*	*	*	7
Chung *et al*[17]	*	*	*	*	…	*	*	*	7
AbdelHalim *et al*[22]	*	…	…	*	…	*	*	*	5
Harland *et al*[18]	*	*	…	*	…	*	*	*	6
Lopez-de-Andrés *et al*[10]	…	*	*	*	*	…	*	*	6
Jung *et al*[20]	…	*	*	*	…	*	*	*	6
Winning *et al*[21]	*	*	*	*	…	*	*	*	7
Zhou *et al*[11]	*	*	…	…	**	*	*	*	7
Kataoka *et al*[12]	*	*	*	*	…	*	*	*	7

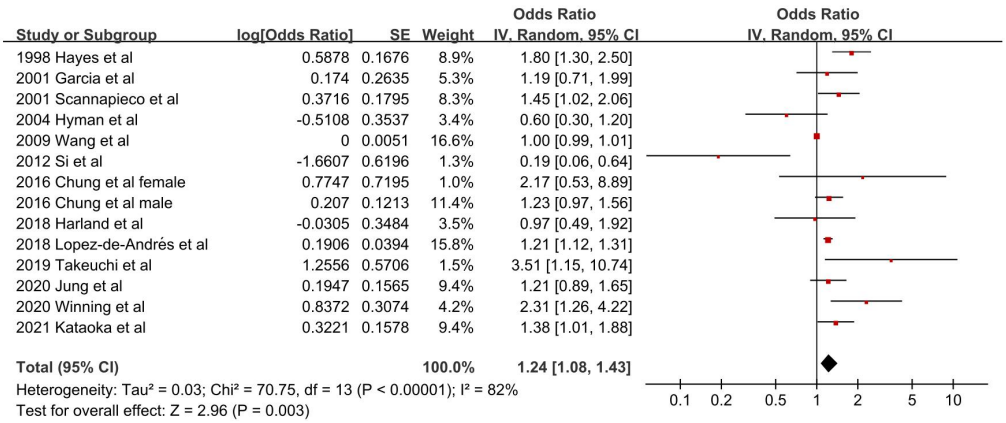

Figure 1 Sensitivity analysis on studies with larger sample size (N ≥500). Values more than one indicate a higher risk of COPD in patients with PD.

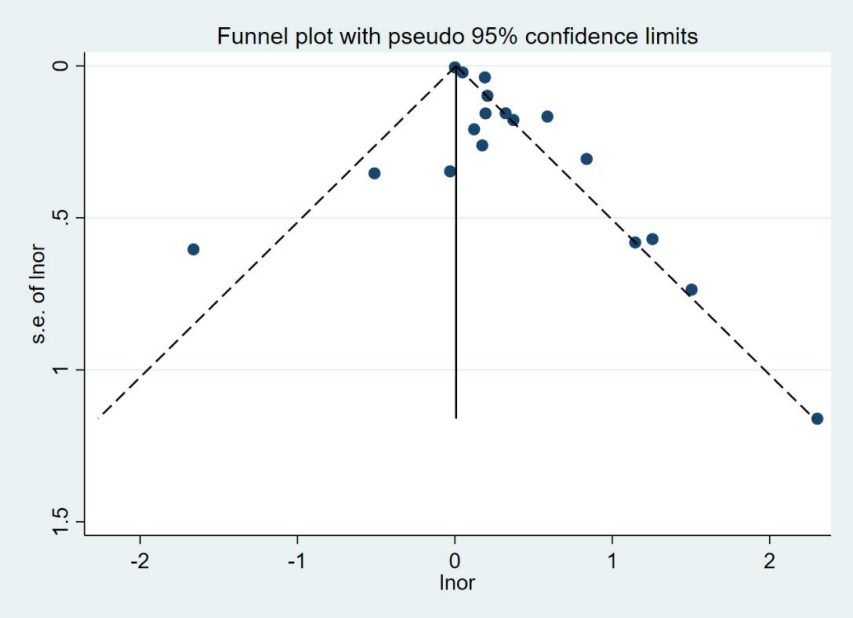

Figure 2 Funnel plot for the risk of COPD, with pseudo 95% confidence limits.

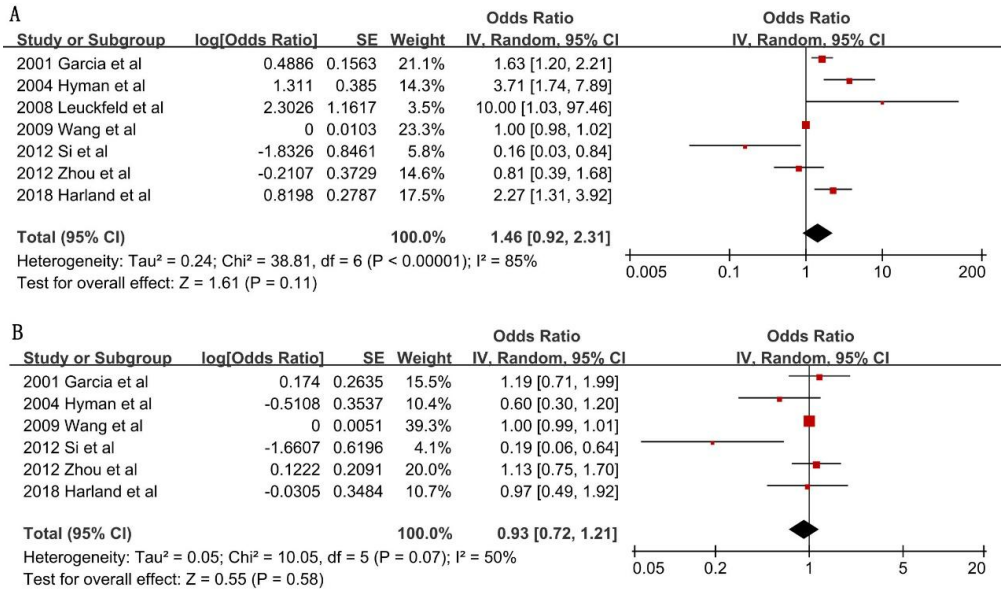

Figure 3 Forest plot of the risk of COPD by periodontal disease. A in smokers and B in never smokers. Values more than one indicate a higher risk in patients with periodontal disease.

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