

Effect of home bleaching on the oral health-related quality of life of adults: A systematic review and meta-analysis

Dr. Mansi Vandekar¹, Dr. Gayatri Pendse², Dr. Nikita Toprani³, Dr. Ellina Tewary⁴,
Dr. Priyanka Panikkar⁵, R. Priya Yadav⁶

¹ MDS, head of department, Professor, Department of Conservative Dentistry and Endodontics, Dy Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India)

^{2,3} MDS, Professor, Department of Conservative Dentistry and Endodontics, Dy Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India)

⁴ PG Student Department of Conservative Dentistry and Endodontics, Dy Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India)

⁵ MDS, Lecturer Department of Conservative Dentistry and Endodontics, Dy Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India)

⁶ PG Student Department of Conservative Dentistry and Endodontics, Dy Patil, University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India

Abstract—BACKGROUND: Tooth discoloration can adversely affect oral health-related quality of life (OHRQoL), encompassing physical, psychological, and social well-being. Dental bleaching, increasingly sought for aesthetic enhancement, utilizes hydrogen or carbamide peroxide through home- or office-based techniques. **Aim:** This review aimed to compare the effects of home and office bleaching on OHRQoL in adults. **Materials and method:** This systematic review and meta-analysis adhered to PRISMA 2020 guidelines and the PICOS framework and synthesize evidence from RCTs, cohort, and observational studies. A structured methodology was used, including comprehensive literature search, study selection, data extraction, risk of bias assessment, and statistical analysis. **Result:** Review revealed that younger adults showed more consistent OHRQoL improvement, with no gender-based differences despite female predominance. Lower peroxide concentrations reduced sensitivity while maintaining similar benefits. Short-term gains were evident, with slight relapse by 6 months; greater baseline discoloration yielded larger improvements. **Conclusion:** This review shows that tooth bleaching—significantly improves OHRQoL in adults. Outcomes vary by technique and patient factors, highlighting the need for personalized planning and use of desensitizing strategies. Integrating patient-centered outcomes is essential for optimal esthetic care.

Index Terms—Home bleaching; oral health-related quality of life; Dental discolouration; tooth whitening

I. INTRODUCTION

Dental discoloration is a common concern among patients, with tooth whitening being a frequently sought treatment to enhance aesthetics.^[1] Over the past three decades, demand for conservative cosmetic dentistry has risen significantly, driven by increasing public interest in brighter teeth and the alignment of aesthetic care with overall health and quality of life.^[2] Extrinsic stains, which affect the outer enamel surface, are typically caused by food, beverages, tobacco use, and poor oral hygiene. They are more common and easier to manage than intrinsic stains, though their persistence depends on exposure to staining agents and the effectiveness of preventive care.^[3]

The demand for whiter teeth has advanced dental bleaching, leading to both home and in-office techniques. Bleaching uses oxidising agents such as hydrogen or carbamide peroxide to treat intrinsic and extrinsic stains.^[4-7] Home and office bleaching are the primary whitening methods, each with distinct advantages.^[8] Home bleaching uses low-concentration

peroxide gels applied via trays or strips, providing gradual, convenient, and cost-effective results.^[8,9] However, treatment outcomes may be affected by patient compliance and application variability. In contrast, office bleaching uses high-concentration peroxide gels for rapid results in a controlled setting, but is costlier and may cause greater sensitivity and soft tissue irritation.^[10,11,12] Despite its popularity, concerns about effectiveness, durability, and safety remain warranting evaluation of different techniques, particularly their impact on oral health-related quality of life (OHRQoL).^[13]

Oral health-related quality of life (OHRQoL) encompasses the physical, psychological, and social aspects of well-being related to oral health.^[12] Tooth discoloration can negatively affect self-confidence and social interactions, underscoring the importance of dental aesthetics.^[14] Consequently, bleaching aims to improve both tooth colour and patient satisfaction. Its impact on OHRQoL is commonly assessed using tools such as OHIP, DIDL, and OASIS, with outcomes varying between home and office techniques due to differences in duration, effectiveness, and sensitivity.^[15]

Post-bleaching sensitivity is a common adverse effect, often due to transient pulpal inflammation, enamel dehydration, or peroxide penetration into dentinal tubules.^[17] It is typically greater with high-concentration, office-based treatments.^[17] Desensitising agents such as fluoride, potassium nitrate, and CPP-ACP can help reduce discomfort. However, potential effects on enamel properties and bonding highlight the need for further evaluation of long-term safety and efficacy.^[18-20]

The effectiveness of home and office bleaching in terms of aesthetics, longevity, and patient satisfaction remains debated. Office bleaching offers immediate results, whereas home bleaching provides gradual whitening with potentially better long-term stability.^[21,22] Rebound discoloration and factors such as diet, lifestyle, and maintenance significantly influence the durability of outcomes.^[6,23-25]

Given the growing demand for minimally invasive aesthetic treatments, this systematic review and meta-analysis compares home and office bleaching to assess

their efficacy and impact on OHRQoL. It evaluates differences in whitening effectiveness, sensitivity, patient satisfaction, and long-term outcomes, providing evidence to guide clinical decision-making and treatment selection.

II. METHODOLOGY

Study design: This systematic review and meta-analysis adhered to PRISMA 2020^[25] guidelines and the PICOS framework, with protocol registration in PROSPERO (CRD42025641519). It aimed to compare the effects of home and office bleaching on OHRQoL in adults by synthesizing evidence from RCTs, cohort, and observational studies. A structured methodology was used, including comprehensive literature search, study selection, data extraction, risk of bias assessment, and statistical analysis.

Eligibility was determined using predefined inclusion and exclusion criteria.

Review Question

This systematic review was designed to address the following research questions:

- How does home bleaching impact on OHRQoL
- How does office bleaching impact on OHRQoL
- How does home bleaching differ from and office bleaching and affect OHRQoL

Search strategy:

A systematic search was conducted across PubMed/MEDLINE, Scopus, Cochrane Library, Web of Science, and Google Scholar for studies on home and office bleaching and OHRQoL (inception–February 2025). MeSH terms and free-text keywords were combined using Boolean operators to optimise sensitivity and specificity.

Inclusion criteria:

- Studies that assessed OHRQoL in adults (≥ 18 years old) undergoing home or office bleaching procedures.
- Studies reporting on at least one validated measure of OHRQoL, such as the Oral Health Impact Profile (OHIP) or the Dental Impact on Daily Living (DIDL) questionnaire.

- Studies that directly compared home bleaching and office bleaching techniques.
- Randomized controlled trials (RCTs), prospective and retrospective cohort studies, and observational studies with a control group.
- Articles published with full text available in the English language.

Exclusion criteria

- Studies involving pediatric or geriatric populations exclusively.
- Studies where participants had dental restorations that could affect bleaching outcomes.
- Studies involving participants with systemic conditions or medication-induced intrinsic discoloration.
- Studies that did not measure OHRQoL or did not provide quantitative or qualitative data relevant to patient experience.
- Conference abstracts, editorials, expert opinions, case reports, and in vitro studies.

Study Selection Process:

Study selection followed a two-stage process. Two reviewers independently screened titles and abstracts, retrieving full texts where eligibility was unclear. Full-text articles were then assessed against predefined criteria, with disagreements resolved by consensus or a third reviewer. Inter-rater agreement was 0.8, and the process was documented using a PRISMA flow diagram.

Data extraction:

A standardized, pilot-tested data extraction form was used. Two reviewers independently extracted and cross-checked data on study characteristics, participant demographics, interventions and comparators, outcomes (OHRQoL, satisfaction, shade change, sensitivity, irritation, compliance), follow-up duration, and adverse effects. Discrepancies were resolved by discussion or a third reviewer, and data were recorded in Excel for analysis.

Risk of Bias Assessment

Data Synthesis and Statistical Analysis

Risk of bias was assessed using study-specific tools: RoB 2 for RCTs, ROBINS-I for non-randomized studies, and the Newcastle-Ottawa Scale for

observational studies.^[26-28] Each study was rated as low, moderate, or high risk, with high-risk studies included in sensitivity analyses to assess their impact on outcomes. Studies were categorized as low, moderate, or high risk of bias, with high-risk studies included in sensitivity analyses. The quality of evidence was evaluated using the GRADE approach, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias. Each outcome was rated as high, moderate, low, or very low quality based on the overall body of evidence.

Result

Nine studies met the inclusion criteria, evaluating the effects of home and/or office bleaching on OHRQoL in adults using validated measures.^[29-39] Five studies compared both modalities, while four assessed home bleaching only. Data are summarized in the Master Chart. Studies were conducted across six countries, mainly Brazil (n=4) and Portugal (n=2), with one each from New Zealand, Chile, and the USA. All were prospective trials, including seven RCTs, one cohort, and one pre-post study; four employed double/triple blinding.

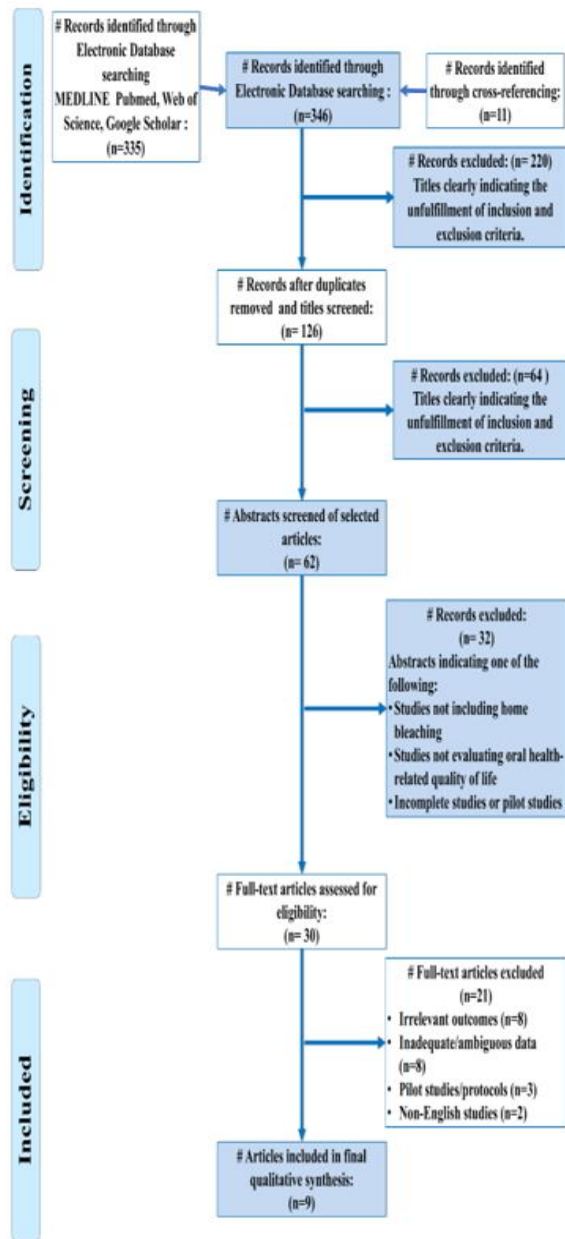


Figure 1: PRISMA Flow diagram indicating the selection process of the articles in the present systematic review

Sample Characteristics: Sample sizes ranged from 50 to 130 participants, mostly involving young to middle-aged adults (18–40 years).^[30,31,34,35]

Baseline Oral Health Status and Diagnostic Criteria: Most studies included subjects with tooth shades darker than A2/A3 (VITA guide), assessed using visual matching and/or spectrophotometry.

Intervention: Home bleaching used 10–22% carbamide peroxide or 6% hydrogen peroxide in trays, applied 1–4 hours daily for 2–3 weeks (sometimes overnight). Office bleaching used 35–37.5% hydrogen peroxide, typically with activation, over 1–3 weekly sessions.

OHRQoL Measurement Instruments

OHRQoL was assessed using validated tools, primarily OHIP-14 (six studies). Other measures included Oral Impact on Daily Performance (OIDP), Oral Aesthetic Subjective Impact Scale (OASIS), the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ), and the Oral Esthetic Scale (OES) to evaluate psychosocial and aesthetic impacts. The baseline OHRQoL scores varied across studies. For instance, Goettems et al. (2021) reported a baseline OHIP-14 score of 20.02 ± 7.12 , while Tavarez et al. (2021) reported a much lower baseline of 7.08 ± 5.54 , suggesting population-specific differences in baseline esthetic dissatisfaction.^[33,37] Following treatment, most studies observed statistically significant reductions in OHRQoL scores, indicative of improvement. Jum'ah et al. (2024) observed the greatest score reduction in the combined bleaching group (-8.1 ± 5.7), compared to home bleaching (-2.7 ± 7.4).^[31]

Improvement in OHRQoL

Seven of the nine studies demonstrated a positive effect of bleaching on OHRQoL. Studies comparing both modalities (e.g., Goettems et al., Jum'ah et al., Pereira et al., and Nunes et al.) found that both home and office bleaching improved OHRQoL, although home bleaching was often associated with lower sensitivity.^[29-32] Jum'ah et al. further reported that combined bleaching (home + office) yielded the most consistent improvement across all OHRQoL domains.^[31] On the other hand, Bruhn et al. (2012) reported no overall improvement in OHIP-49 scores after home bleaching, although a slight improvement was seen in the "handicap" domain.^[35] Tavarez et al. (2021) also found no significant change in OHIP-14 or OASIS scores, though minor domain-specific improvements in psychological discomfort were noted.^[37]

Tooth Sensitivity

Goettems et al. reported 70% sensitivity incidence in the office group versus 56% in the home group. Oliveira Barros et al. (2022) introduced 1.5% potassium oxalate as a desensitizing agent and demonstrated significantly reduced sensitivity levels, without compromising bleaching efficacy.^[30,33]

Studies such as Meireles et al. (2014) and Bruhn et al. (2012) observed that sensitivity negatively impacted OHRQoL, especially in physical pain and hygiene-related domains.^[35,36] Pereira et al. (2022), despite using lower peroxide concentrations, also reported mild but frequent sensitivity in all groups.^[29]

Adverse effects were mild and transient, mainly tooth sensitivity and gingival irritation, with no severe complications or discontinuations, and were effectively reduced by desensitizing agents and lower peroxide concentrations.

Age and gender- Most studies involved younger adults (18–35),^[29–37] who showed greater OHRQoL improvement—especially psychosocial benefits—while older cohorts showed minimal impact, suggesting age influences responsiveness to aesthetic dental treatments. Most studies had predominantly female participants; although no gender-specific analyses were conducted, women tended to report greater baseline aesthetic dissatisfaction, suggesting potentially higher responsiveness, though this remains speculative.

Bleaching Agent Concentration- Bleaching agents were classified as low (<10%) and high (≥10%) peroxide concentrations. Low concentrations (6% hydrogen peroxide or 10% carbamide peroxide) were used by Pereira et al. (2022), Oliveira Barros et al. (2022), and some arms of Jum'ah et al. (2024) and Nunes et al. (2023).^[29,31–33] High concentrations (≥16% carbamide peroxide or ≥35% hydrogen peroxide) were reported by Goettems et al. (2021), Bruhn et al. (2012), Bersezio et al. (2018), Meireles et al. (2014), and other arms of Jum'ah and Nunes studies.^[30–32,34–39] High concentrations produced slightly greater immediate whitening but were associated with increased sensitivity and discomfort.^[30,34] OHRQoL improvement was comparable across groups, suggesting low concentrations, especially with desensitizers, offer a more comfortable and equally effective alternative.^[33]

Follow-up Duration

Short-term duration studies (<6 months) included Goettems et al. (2021), Oliveira Barros et al. (2022), Bruhn et al. (2012), Meireles et al. (2014), Bersezio et al. (2018), and Tavaréz et al. (2021) [33,36,38,39,40]^[30,33,35–37] which showed immediate OHRQoL improvement, while long-term studies (≥6 months) included Pereira et al. (2022), Jum'ah et al. (2024), and Nunes et al. (2023)^[31,32] indicated some relapse in shade and satisfaction, particularly with high concentrations. However, sustained benefits were observed with combined bleaching approaches at six months.^[29,31]

Baseline Discoloration Severity

Discoloration was classified as mild/moderate (A2–A3) or severe (>A3.5). Mild/moderate cases were reported in studies by Goettems, Meireles, Oliveira Barros, and Tavaréz,^[30,42,39,37] while severe discoloration was included in studies by Pereira, Nunes, and Jum'ah; Bruhn and Bersezio included a broader range.^[29,31,32,40,41] Greater improvements in aesthetic satisfaction and OHRQoL were observed in severely discolored teeth due to more noticeable shade change, whereas mild cases showed more modest improvements.^[29,31]

Risk of bias was assessed using RoB 2 for RCTs, ROBINS-I for non-randomized studies, and the Newcastle–Ottawa Scale (NOS) for observational studies.^[26,28]

	Risk of bias domains					
	D1	D2	D3	D4	D5	Overall
Goettems et al. (2021)						
Pereira et al. (2022)						
Jum'ah et al. (2024)						
Nunes et al. (2023)						
Oliveira Barros et al. (2022)						
Meireles et al. (2014)						
Bersezio et al. (2018)						

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
 Some concerns
 Low

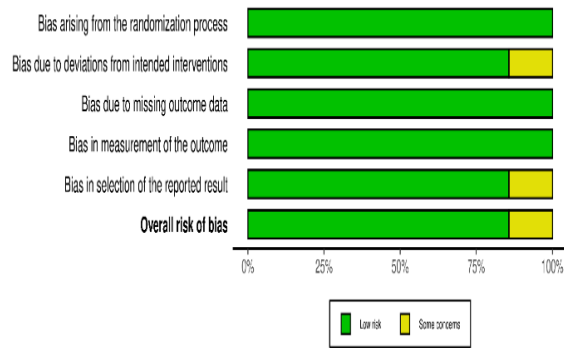


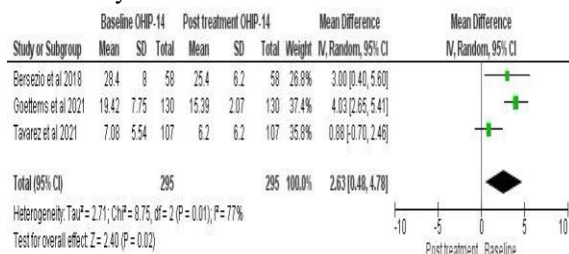
Figure 2: Risk of bias assessed in the randomized controlled trials using the Cochrane RoB-2 tool

Randomized Controlled Trials (RoB 2 Tool)

Of the nine included studies, seven were RCTs assessed using the Cochrane RoB 2 tool (Figure 2),^[26] including Goettems et al. (2021), Pereira et al. (2022), Jum'ah et al. (2024), Nunes et al. (2023), Oliveira Barros et al. (2022), Meireles et al. (2014), and Bersezio et al. (2018).^[29-34,36] Most RCTs showed low risk of bias across key domains, with Bersezio et al. (2018) having some concerns due to possible deviations and selective reporting.^[34] Overall, six of seven RCTs were judged low risk, indicating strong internal validity.

Quality assessment of the evidence using GRADE Approach indicated Moderate-quality evidence indicates that both home and office bleaching improve OHRQoL, though this is tempered by variability in outcomes. Evidence for combined approaches is limited and of low quality due to the small number of studies and imprecision. Findings for tooth sensitivity and patient satisfaction are also of moderate quality, constrained by subjective assessments and inconsistent follow-up periods. Publication bias could not be evaluated, and no clear evidence of bias was observed.

Meta-analysis:



The forest plot meta-analysis of three studies ($n=295$) showed that 10% carbamide peroxide significantly improved OHRQoL, with a reduction in OHIP-14 scores (mean difference = 2.63; 95% CI: 0.48–4.78). High heterogeneity ($I^2 = 77\%$) warranted a random-effects model; however, the overall effect remained significant ($Z = 2.40$, $P = 0.02$), indicating a modest but meaningful improvement in patient-reported outcomes.

III. DISCUSSION

This review demonstrates that both home and in-office bleaching significantly improve OHRQoL in adults, with consistent evidence of psychological and social benefits.^[29-39]

Home bleaching with low-concentration carbamide or hydrogen peroxide effectively improves OHRQoL, particularly in younger patients with moderate discoloration.^[5,29-31, 36, 40] Its gradual oxidative action over 2–3 weeks offers convenient, cost-effective at-home treatment.^[41,42] Studies by Meireles et al. and Pereira et al. reported improved smile satisfaction, reduced embarrassment, and greater social confidence after bleaching.^[29,36] Benefits were notable in self-consciousness, social avoidance, and emotional well-being,^[43] emphasizing the importance of patient-centered outcomes in dental care.^[44]

In-office bleaching uses high-concentration hydrogen peroxide for rapid results but is associated with increased tooth sensitivity and soft tissue irritation.^[30-31,45-46] This transient discomfort, due to peroxide diffusion and pulpal response, may limit patient acceptance, necessitating a balance between efficacy and tolerability, especially in sensitive individuals.^[10,47-50]

Combined bleaching (office followed by home) yields the most consistent and sustained OHRQoL improvement, combining rapid whitening with long-term stability.^[51] Jum'ah et al. reported greater color change and prolonged psychological benefits, especially in younger adults, supporting its use for severe discoloration and lasting satisfaction.^[31,52]

OHRQoL improvements were not uniform across studies;^[29,37] some reported no significant overall change, despite gains in specific domains like smile confidence.^[35,47] Variability may reflect low baseline concern, older age, limited shade contrast, or less sensitive measures, highlighting the need to consider

patient expectations and cultural factors in esthetic care.^[10,53] Tooth sensitivity was the most common adverse effect, though typically self-limiting and impactful on patient experience.^[54,55] Desensitizers such as potassium oxalate and CPP-ACP reduced sensitivity without affecting efficacy or satisfaction,^[33] improving tolerability and supporting patient-centered treatment planning.^[56]

Clinically, bleaching impacts psychosocial well-being beyond aesthetics. Treatment choice should consider patient condition, goals, lifestyle, and sensitivity: in-office for rapid results, home for cost-effective gradual improvement, and combined approaches for severe discoloration and optimal long-term outcomes.^[57-59] Key limitations include heterogeneity in OHRQoL measures (OHIP-14, OIDP, PIDAQ, OASIS), limiting comparability,^[26-28] inadequate reporting of baseline psychosocial factors, short follow-up periods, and methodological variability in bleaching protocols and concentrations, warranting cautious interpretation of pooled results.^[29-37]

Future research should standardize OHRQoL measures and bleaching protocols, with longer follow-up (>6 months) to assess durability. Studies should include diverse populations and integrate objective outcomes (enamel hardness, color relapse, pulpal health) with patient-reported measures, while exploring adjuncts, digital shade matching, and minimally invasive formulations.

Tooth bleaching—home, in-office, or combined—improves OHRQoL, with outcomes varying by patient and clinical context. Personalized planning, patient education, and use of desensitizers optimize benefits and minimize adverse effects, emphasizing the importance of patient-centered care in esthetic dentistry.^[58,59]

IV. CONCLUSION

This review shows that both home and in-office bleaching improve OHRQoL by enhancing esthetics and psychosocial well-being. Home bleaching is cost-effective and well-tolerated, while in-office offers rapid results but higher sensitivity; combined approaches provide the most consistent, long-term benefits. Treatment should be individualized, with desensitizers and patient education to optimize outcomes. Further standardized, long-term studies are

needed, as bleaching contributes to overall patient well-being beyond cosmetic effects.

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