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Comparative Evaluation of Golden Proportion, Recurring Esthetic Dental (RED) Proportion, and Preston Proportion in Natural Dental Esthetics – A systematic review

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ABSTRACT

Background:
Dental esthetics play a pivotal role in enhancing facial attractiveness and patient confidence, especially in the maxillary anterior region. Theoretical models such as the Golden Proportion, Recurring Esthetic Dental (RED) Proportion, and Preston Proportion have been widely proposed to guide esthetic smile design. However, their applicability and prevalence in natural dentition across populations remain debatable. This systematic review aimed to evaluate and compare the clinical relevance and natural occurrence of these three proportions in individuals with untreated anterior maxillary teeth.

Objective:
To assess and compare the prevalence, consistency, and clinical utility of the Golden Proportion, RED Proportion, and Preston Proportion in natural maxillary anterior dentition across diverse populations.

Methods:
The review followed PRISMA 2020 guidelines and was registered in PROSPERO (CRD42024558371). A comprehensive literature search was performed across PubMed, MEDLINE, Cochrane Central, and DOAJ up to July 2024. Studies included were observational, cross-sectional, or clinical trials evaluating naturally present maxillary anterior teeth without prior restorations or orthodontic treatment. Data extraction and risk of bias assessment were conducted independently by two reviewers using standardized templates and the Newcastle-Ottawa Scale. Qualitative synthesis and meta-analysis were performed using RevMan 5.4, with heterogeneity assessed through the I^2 statistic.

Results:
Out of 957 articles initially identified, 13 studies were included in the final analysis. All included studies were cross-sectional and encompassed diverse ethnic populations from India, Iran, Turkey, Spain, Kenya, and more. The Golden Proportion showed limited natural occurrence, with compliance rates ranging from 0% to 66.7%, and was most commonly found between central and lateral incisors. The RED Proportion, though preferred by clinicians, showed inconsistent natural occurrence across studies. The Preston Proportion demonstrated the least adherence, with several studies reporting 0% compliance. No proportion demonstrated universal applicability. Meta-analytic trends confirmed significant variability across ethnicities and populations.

Conclusion:
None of the three evaluated proportions were consistently observed in natural dentition across all populations. While they offer conceptual frameworks for smile design, rigid application may not be clinically appropriate. A personalized, patient-specific approach—considering individual tooth morphology, facial symmetry, and esthetic expectations—is recommended over adherence to universal proportional models

Keywords: Golden Proportion; RED Proportion; Preston Proportion; Dental Esthetics; Maxillary Anterior Teeth; Smile Design; Systematic Review

1. INTRODUCTION

The growing influence of social media, advertising, and celebrity culture has fueled a significant rise in the demand for cosmetic dental procedures. As a result, aesthetic considerations have become a central component in comprehensive dental treatment planning. The smile, a vital aspect of facial attractiveness, plays a key role in both interpersonal communication and the self-image of an individual [1]. Smile design is a fusion of artistic perception and scientific principles, aimed at achieving harmonious and natural-looking outcomes [2]. The concept of beauty is inherently subjective and is shaped by cultural, psychological, and philosophical factors. Deep psychological sentiments and social values are attached to the appearance of anterior teeth [3]. Numerous dental anomalies, ranging from caries and discoloration to malocclusion and trauma, can adversely affect aesthetics and may necessitate restorative or prosthetic interventions [4].

Smile aesthetics can be categorized into facial, gingival, macro, and micro components. The microesthetic features, particularly the proportions and arrangement of the maxillary anterior teeth, have attracted significant attention. Geometric and mathematical principles like the Golden Proportion, Recurring Esthetic Dental (RED) Proportion, and Preston Proportion have been proposed to guide clinicians in achieving optimal anterior tooth symmetry and balance [5–8].

The Golden Proportion, rooted in Euclidean geometry, describes an ideal ratio of 1.618:1 and is often cited as a universal marker of aesthetic harmony [5]. Pioneers like Lombardi and Levin introduced its application in dental esthetics, observing consistent proportional relationships among anterior teeth [9,10]. Despite its widespread adoption, questions remain about its universality in natural dentitions.

In contrast, Ward proposed the RED Proportion, which focuses on a constant percentage reduction in visible tooth width as one moves distally from the central incisor [6]. Preston, meanwhile, suggested different average ratios for lateral and canine widths, offering another perspective on esthetic proportions [11].

While literature exists on each of these theories individually, comparative studies encompassing all three proportions are scarce. Therefore, this systematic review aims to critically evaluate and compare the reliability and clinical relevance of the Golden, RED, and Preston proportions in natural dental esthetics, helping clinicians make informed decisions in smile design.

2. METHODOLOGY

Protocol Registration and Reporting Framework

This systematic review and meta-analysis were conducted following the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020)* guidelines [12]. The review protocol was prospectively registered in the PROSPERO database under the registration number CRD42024558371.

Focused Review Questions and PICO Framework

This review was conducted to address two core questions: (1) How do the Golden Proportion, Recurring Esthetic Dental (RED) Proportion, and Preston Proportion compare in their representation of natural dental esthetics? (2) What are the clinical outcomes and applicability associated with each of these esthetic proportions? The review was structured using the Population-Exposure-Comparator-Outcome (PICO) framework. The population of interest included human subjects with naturally present maxillary anterior permanent teeth, with no prior orthodontic or prosthetic interventions. The exposures considered were studies evaluating dental esthetics using either the Golden Proportion, RED Proportion, or Preston Proportion. The comparator involved direct or indirect comparisons between these aesthetic concepts. The primary outcomes assessed included the prevalence of these proportions within studied populations and variations across gender or ethnicity.

Eligibility Criteria

Studies were included if they assessed naturally present maxillary anterior permanent teeth without any restorations or orthodontic modifications. Eligible studies could be observational or interventional in nature, including descriptive cross-sectional studies, prospective or retrospective clinical studies, randomized controlled trials (RCTs), and non-randomized clinical trials. Only studies with accessible full-text articles and those published up to July 31, 2024, were considered. Studies in any language were included, provided they had an available English translation. Exclusion criteria were clearly defined and included review articles, case reports, case series, animal or in vitro studies, and articles that lacked full text or did not report relevant outcomes aligned with the study objectives.

Search Strategy and Data Sources

A comprehensive literature search was conducted across four major electronic databases: PubMed, MEDLINE (via PubMed Central), Cochrane Central Register of Controlled Trials (CENTRAL), and Directory of Open Access Journals (DOAJ). No restrictions were applied concerning the language or geographic origin of publication. Search strategies were tailored to each database using a combination of free-text keywords and controlled vocabulary terms (MeSH) relevant to the topic, such as “maxillary anterior teeth,” “Golden Proportion,” “Recurring Esthetic Dental Proportion,” “RED,” “Preston Proportion,” and “tooth width ratios.” Boolean operators were used to refine the searches, and advanced filters were applied to limit the results

to relevant study designs such as cross-sectional studies and clinical trials. The search was concluded in July 2024. The final search strategy and number of articles retrieved from each database are detailed in Table 1.

Table 1: Search strategy in different databases:

Database	Search	Number of articles obtained
PubMed	((human dentition AND maxillary anterior teeth) AND (Esthetic proportion OR Golden Proportion OR Recurring Esthetic Dental Proportion OR RED OR Preston proportion)) AND (cross-sectional study)	8
PMC/MEDLINE	((((("humans"[MeSH Terms] OR "humans"[All Fields] OR "human"[All Fields]) AND ("dentition"[MeSH Terms] OR "dentition"[All Fields])) AND (("maxilla"[MeSH Terms] OR "maxilla"[All Fields] OR "maxillary"[All Fields]) AND anterior[All Fields] AND ("tooth"[MeSH Terms] OR "tooth"[All Fields] OR "teeth"[All Fields]))) AND ((("esthetics"[MeSH Terms] OR "esthetics"[All Fields] OR "esthetic"[All Fields]) AND proportion[All Fields]) OR (Golden[All Fields] AND Proportion[All Fields]) OR (Recurring[All Fields] AND ("esthetics"[MeSH Terms] OR "esthetics"[All Fields] OR "esthetic"[All Fields]) AND ("dental health services"[MeSH Terms] OR ("dental"[All Fields] AND "health"[All Fields] AND "services"[All Fields]) OR "dental health services"[All Fields] OR "dental"[All Fields]) AND Proportion[All Fields]) OR "red"[All Fields] OR (Preston[All Fields] AND proportion[All Fields]))) AND ("cross-sectional studies"[MeSH Terms] OR ("cross-sectional"[All Fields] AND "studies"[All Fields]) OR "cross-sectional studies"[All Fields] OR ("cross"[All Fields] AND "sectional"[All Fields] AND "study"[All Fields]) OR "cross sectional study"[All Fields])	629
Cochrane central library	("Maxillary Anterior teeth" OR "Maxillary Central Incisor" OR "Maxillary Lateral Incisor" OR "Maxillary Anterior Teeth Width" OR "Maxillary Central Incisor Width" OR "Maxillary Lateral Incisor Width" OR "Proportion" OR "Width Proportion" OR "Tooth Proportion" OR "Tooth Width") AND ("Golden Proportion")	89
DOAJ	("Maxillary Anterior teeth" OR "Maxillary Central Incisor" OR "Maxillary Lateral Incisor" OR "Maxillary Anterior Teeth Width" OR "Maxillary Central Incisor Width" OR "Maxillary Lateral Incisor Width" OR "Proportion" OR "Width Proportion" OR "Tooth Proportion" OR "Tooth Width") AND ("Golden Proportion") AND ("RED Proportion") AND ("Preston Proportion")	231

Study Selection and Screening Process

Following the removal of duplicate records using reference management software, the titles and abstracts of all retrieved articles were screened independently by two reviewers. Any disagreements during this stage were resolved through discussion or consultation with a third senior reviewer. Studies meeting the preliminary criteria were then evaluated in full text. The full-text articles were scrutinized to determine whether they met the eligibility criteria in terms of population, study design, and reported outcomes. Articles that lacked clear methodological detail, did not focus on anterior tooth proportions, or failed to report relevant ratios were excluded at this stage. The complete selection process is illustrated using a PRISMA flow diagram, highlighting the number of records at each stage of screening and final inclusion.

Data Extraction and Management

Data were extracted independently by two reviewers using a predesigned data extraction sheet. The extracted parameters included study identifiers (authors, year, and title), geographical location, study design, sample size, demographic details of participants, measurement methods (photographic or cast-based), proportion criteria used, data analysis techniques, reported outcomes, and key conclusions. Additional information such as ethical clearance, sampling methods, and conflicts of interest were also noted when available. To ensure consistency, the extracted data were cross-verified, and discrepancies were

resolved through discussion. The final data were systematically compiled into structured tables for qualitative synthesis and quantitative analysis, where applicable.

Risk of Bias Assessment

The methodological quality of the included studies was appraised using the *Newcastle-Ottawa Scale* (NOS) adapted for cross-sectional studies. Two independent reviewers assessed the risk of bias based on criteria including sample representativeness, adequacy of sample size, comparability of respondents and non-respondents, validity of the exposure measurement, and appropriateness of the statistical analyses. Each study was awarded stars across three categories: selection, comparability, and outcome assessment. Studies scoring 8 or more stars were considered to have low risk of bias, those with 6 to 7 stars as moderate risk, and studies with 5 or fewer stars as high risk of bias. Of the 13 included studies, four were judged to have high risk, and nine were considered to have moderate risk. A summary of the scoring and individual assessments is provided in Table 2.

Table 2: Risk of bias assessment using the Newcastle Ottawa Scale.

Study Id	Selection				Comparability		Outcome		Total score
	Representativeness of sample	Sample size	Non-responders	Ascertainment of exposure	Main factor	Additional factor	Assessment of outcome	Statistical test	
Murthy 2008	*	-	-	*	*	-	*	*	5
Meshramkar 2013	*	-	*	*	*	-	*	*	6
Azimi 2016	*	-	*	*	*	*	*	*	7
Maharjan 2018	*	*	*	*	*	-	*	*	7
Ozdemir 2018	*	-	-	*	*	-	*	*	5
Mahajan 2019	*	-	-	*	*	-	*	*	5
Melo 2019	*	*	*	*	*	-	*	*	7
Ionas 2020	*	-	-	*	*	-	*	*	5
Kalia 2020	*	-	*	*	*	-	*	*	6
Arya 2021	*	-	*	*	*	-	*	*	6
Rodríguez-López 2021	*	-	*	*	*	-	*	*	6
Kabir 2023	*	-	*	*	*	-	*	*	6
Mosomi 2024	*	-	*	*	*	-	*	*	6

3. RESULTS

Study Selection

The initial electronic database search yielded a total of 957 records. After the removal of 774 duplicates, 183 unique titles and abstracts were screened by two independent reviewers. Of these, 57 articles were found to be potentially relevant and were retrieved for full-text evaluation. Upon detailed assessment, 32 articles were excluded for not meeting the eligibility criteria. The remaining 25 articles were further assessed, and after application of inclusion and exclusion criteria based on the PICO framework, 13 studies were deemed eligible for inclusion in the qualitative synthesis [13-25]. No additional records were identified through manual searching of reference lists. These 13 studies formed the basis of the final analysis (Figure 1). The data extracted from these studies is summarized in Tables 3 and 4.

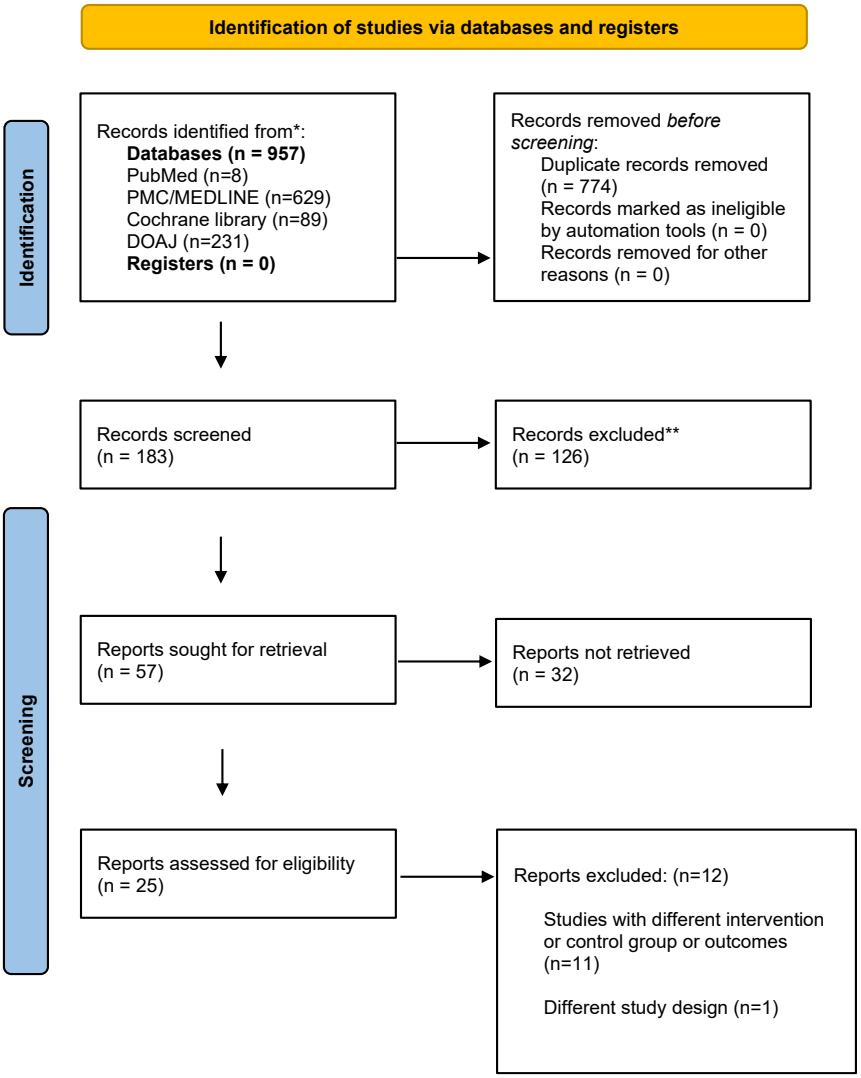

Figure 1: PRISMA 2020 flow diagram

Table 3: Data Extraction Sheet

Study ID	Place of study	Study design	SS calculation	Sample size	Age	Gender		Participants	Data collection tools	Analysis method	golden proportion	RED
						Male	Female					

Murthy 2008	India	cross-sectional	no	56	20-25	20	36	Dental students	photographs	Adobe Photoshop 7	left and right side values given separately	range mentioned
Meshramkar 2013	India	cross-sectional	no	214	18-25	-	-	Dental students	Frontal photograph of middle and lower third of the face	Adobe photoshop CS (version 8.0, 2003 Adobe)	b/w CI,LI: 3.9%, b/w LI,C: 0.6%	6.60%
Azimi 2016	Iran	cross-sectional	no	116	-	28	88	-	Frontal photograph of middle and lower third of the face	Digitize software	b/w CI,LI: 25%, b/w LI,C: 2.1%	18.5 43/232 M:19.6 % 11/56, F: 18.1% 32/176
Maharjan 2018	Nepal	cross-sectional	yes	63	18-35	-	-	Aryan and Mongoloid race	photographs according to AACD guidelines	Adobe Photoshop.CS Version 8	b/w CI,LI: 14.28 %, b/w LI,C:12 .69%	values different for races
Ozdemir 2018	Turkey	cross-sectional	no	150	18-24	81	69	Turkish Dental students	Frontal photographs of the maxillary anterior teeth	Adobe Photoshop CS3 Extended v10.0	-	-
Mahajan 2019	India	cross-sectional	no	200	20-40	100	100	Himachal origin	cast models	manual	5.5% 11/200 males:4 %, 4/100 females :7% 7/100	

Melo 2019	Spain	cross-sectional	no	384	14-35	178	206	Spanish population	cast models	manual using digital calipers	graphical presentation	graphical presentation
Ionas 2020	Romania	cross-sectional	no	61	-	-	-	-	frontal view photographs	-	p value mentioned	p value mentioned
Kalia 2020	UK	cross-sectional	no	509	-	-	-	Dental students	photographs	six anterior teeth were measured using Microsoft PowerPoint by inserting boxes around the teeth and recording their lengths and widths.	mean SD values	mean SD values
Arya 2021	India	cross-sectional	no	250	-	-	-	Dental students	cast models	teeth dimensions measured using digital calliper	range values given	right and left quadrants values given separately
Rodríguez-López 2021	Spain	cross-sectional	no	78	20-64	30	48	Spanish population	Photographic Images collected following the guidelin	vector graphics editor software (Adobe Illustrator 23.1.1)	-	SD values not mentioned

									es of the "American Academy of Cosmetic Dentistry" (AACD)			
Kabir 2023	Bangladesh	cross-sectional	no	108	-	62	46	-	photographs	Digimizer software	72/108 M:62/62, F: 41/46	24/108 M: 16/62, F: 8/46
Mosomi 2024	Kenya	cross-sectional	yes	175	18-35	107	68	African population	photographs taken under natural lighting	Adobe Photoshop 7 software	right and left values mentioned separately	right and left values mentioned separately

Table 4: SUMMARY CHARACTERISTICS TABLE

Study	Country	Sample Size	Study Design	Golden Proportion	RED Proportion	Preston Proportion	Bias Level
Mosomi et al. (2024)	Kenya	175	Cross-sectional	4.0% (right), 2.8% (left)	67%-70% (variable)	Low compliance	Moderate
Handa et al. (2024)	India	150	Observational	3.1% (males), 3.2% (females)	Minimal adherence	Not assessed	Moderate
Jouhar et al. (2024)	Pakistan	120	Cross-sectional	Minimal preference	Preferred by dentists	Not assessed	Moderate
Kabir et al. (2023)	Bangladesh	200	Comparative	66.70%	22.20%	Not assessed	Moderate
Omran et al. (2023)	Saudi Arabia	60	Observational	Not observed	Absent	0% compliance	High
Lucchi et al. (2022)	Italy	400	Retrospective	Some relevance post-orthodontic	Not documented	Some presence	Moderate
RodrÃguez-LÃ³pez et al. (2021)	Spain	78	Cross-sectional	0-16% compliance	70%-80% not observed	3.33%-25% compliance	Moderate
Arya et al. (2021)	India	250	In vivo study	6.24%-6.26%	Not stable	Not relevant	Moderate

Ionas et al. (2020)	Romania	63	Photographic Analysis	Not observed	Not found	Low presence	High
Kalia et al. (2020)	UK	509	Observational	Low prevalence	Absent	Higher than Golden Proportion	Moderate
Aldegheishem et al. (2019)	Saudi Arabia	61	Observational	Not significant	Not applicable	Not assessed	Moderate
Mahajan et al. (2019)	India	200	Comparative	5.5% observed	Some correlation	Limited significance	High
Melo et al. (2018)	Spain	384	Descriptive	Deviation from classic ratio	Limited presence	Not widely applicable	Moderate

Study Characteristics

All 13 included studies adopted a descriptive, cross-sectional study design and were conducted across diverse geographic regions, including India, Iran, Nepal, Turkey, Spain, Romania, the United Kingdom, Bangladesh, and Kenya. The sample sizes of the included studies ranged from 50 to 384 participants, encompassing a broad age range of 18 to 64 years. The racial and ethnic backgrounds of participants included Aryan, Mongoloid, Turkish, Indian, African, and European populations, ensuring wide representation.

Most studies utilized standardized frontal-view photographs for tooth measurement, while three studies relied on dental cast models for evaluating tooth width and height. Ethical approval was reported by all studies, and clear inclusion and exclusion criteria were described consistently. Sample size calculation was explicitly stated in two studies. The mean values for the right central incisor-to-lateral incisor (CI:LI) ratio ranged from 55.80% to 74.67% (mean ± SD = 72.84 ± 4.64), and the right canine-to-lateral incisor (Ca:LI) ratio ranged from 72.27% to 95.46% (mean ± SD = 83.10 ± 6.30). Similar variability was observed on the left side (CI:LI = 55.80%–75.57%; mean ± SD = 71.12 ± 3.83; Ca:LI = 72.52%–93.37%; mean ± SD = 80.22 ± 6.11).

Golden Proportion

The Golden Proportion (1.618:1.0) has traditionally been proposed as an ideal esthetic ratio in anterior dentition, specifically suggesting that the lateral incisor width should be 62% of the central incisor, and the canine 62% of the lateral incisor. However, this review found limited natural occurrence of this proportion. For instance, Mosomi et al. (2024) reported its presence in only 4% (right side) and 2.8% (left side) of participants [25]. Handa et al. (2024) observed similar low prevalence among North Indian subjects—3.1% in males and 3.2% in females [26]. In contrast, Kabir et al. (2023) found a considerably higher prevalence of 66.7% in a Bangladeshi cohort, indicating possible demographic or methodological variability [24]. Rodríguez-López et al. (2021) reported compliance rates between 0% and 16% in a Spanish population [23], and Maharjan et al. (2018) found the Golden Proportion in just 14.28% (CI:LI) and 12.69% (Ca:LI) of cases [16]. Collectively, the findings suggest that although the Golden Proportion remains widely referenced, it lacks consistent applicability in natural dentitions across different populations.

Recurring Esthetic Dental (RED) Proportion

The RED Proportion, as described by Ward, proposes a constant decrease in the visible width of anterior teeth as one moves distally. This proportion is intended to accommodate individual variability in tooth size while maintaining aesthetic harmony. However, its natural occurrence was also inconsistent. Jouhar et al. (2024) reported that clinicians preferred the RED proportion over the Golden Proportion for designing standard esthetic smiles [27]. Despite this preference, several studies challenged its clinical prevalence. Shetty et al. (2011) and Murthy et al. (2008) found the RED proportion to be largely absent or irregular in natural dentition [13,28]. Maharjan et al. (2018) reported RED ratios ranging between 71% and 75%, with variability attributed to ethnic differences [16]. Lucchi et al. (2022) and Kabir et al. (2023) found low adherence to RED proportion standards, the latter reporting its presence in only 22.2% of the analyzed subjects [24,29]. These findings indicate that while the RED Proportion is more adaptable than the Golden Proportion, its reliability as a universal guideline remains debatable.

Preston Proportion

The Preston Proportion posits that the width of the lateral incisor is approximately 66% of the central incisor and that the canine width is about 84% of the lateral incisor. Despite being grounded in clinical observation, this proportion demonstrated the least natural occurrence among the three. Omran et al. (2023) reported 0% compliance with Preston's ratios [30]. Rodríguez-López et al. (2021) noted adherence rates ranging from 3.33% to 25% [23], while Kalia et al. (2020) observed relatively higher prevalence compared to the Golden Proportion, though still inconsistent [21]. The widespread variability

across studies calls into question the practicality of the Preston Proportion as a universal esthetic metric.

Comparative Findings

On comparison, none of the proportions demonstrated universal applicability across populations. The Golden Proportion was slightly more frequently observed than the RED or Preston Proportions, especially in central-to-lateral incisor ratios, though still not predominant. The RED Proportion was often preferred by clinicians for its flexibility but showed low prevalence in natural dentitions. The Preston Proportion had the least support, with some studies reporting no compliance at all. These inconsistencies highlight the ethnically dependent nature of anterior tooth proportions and support the view that rigid application of any one proportion may be clinically inappropriate.

Clinical Implications

The findings from this systematic review suggest that while proportion theories such as the Golden, RED, and Preston proportions provide useful frameworks for esthetic planning, they should not be used as absolute standards. The Golden Proportion remains a widely cited concept but has limited empirical support across diverse populations. The RED Proportion allows for greater individualization but lacks uniformity in clinical observation. The Preston Proportion, despite its origin in clinical measurements, exhibited the lowest natural prevalence. Ultimately, individualized treatment planning based on patient-specific tooth dimensions, facial morphology, and esthetic preferences is recommended over strict adherence to universal proportional theories.

4. DISCUSSION:

A harmonious smile is a composite of dental, facial, and esthetic components, where symmetry, proportion, and balance play critical roles in achieving facial attractiveness. One of the primary challenges in esthetic dentistry lies in selecting the appropriate dimensions, particularly the mesiodistal width, of the maxillary anterior teeth during restoration or smile design. Numerous theoretical models have been proposed to standardize this process, among which the Golden Proportion, Recurring Esthetic Dental (RED) Proportion, and Preston Proportion have gained widespread recognition [5-8]. However, their clinical relevance and applicability to natural dentition across populations have been subjects of continued debate. This systematic review and meta-analysis aimed to comparatively evaluate the prevalence and reliability of these three esthetic proportion systems in naturally occurring dentitions using a rigorously designed and PRISMA-compliant methodology.

Across the reviewed literature, the Golden Proportion emerged as a frequently referenced concept, originally advocated as a universal marker of esthetic harmony. However, the findings of this review demonstrated that while the Golden Proportion was occasionally observed, particularly in the relationship between central and lateral incisors, its overall prevalence was limited. Studies such as those by Mosomi et al., Maharjan et al., and Rodríguez-López et al. reported compliance rates between 2% and 16%, suggesting that this proportion does not consistently appear in natural dentition [16,23,25]. Moreover, while the Golden Proportion continues to enjoy academic popularity, its application in routine clinical practice may lead to artificial or over-engineered outcomes, especially when not adapted to individual facial and dental characteristics.

The RED Proportion, which offers more flexibility by proposing a constant decremental ratio in tooth width from the midline posteriorly, was found to be favored by clinicians, particularly in the context of standard-sized or shorter teeth. However, empirical evidence for its presence in natural dentition remains limited. Several studies concluded that the RED Proportion was either inconsistent or entirely absent in clinical samples [13,24,28]. This variability likely arises from its sensitivity to tooth morphology and individual anatomical variation. Although the RED Proportion allows for patient-specific adaptation, its inconsistent natural occurrence diminishes its utility as a standardized esthetic guideline.

The Preston Proportion, suggesting a more conservative width ratio between adjacent anterior teeth, demonstrated the least compliance among the three models. Studies such as those by Omran and Rodríguez-López reported minimal to zero adherence to Preston's criteria, raising questions about its real-world applicability [23,30]. Despite its clinical origin, the Preston Proportion appears to oversimplify the complex interplay of dental and facial dimensions, making it less suited as a universal guideline. In many studies, its assumptions failed to align with natural tooth widths in diverse ethnic populations.

Notably, the findings of this review underscore a recurring theme: none of the three esthetic proportions evaluated were universally present across all included populations. Ethnic diversity, tooth size variability, and methodological differences contribute to the heterogeneity observed across studies [31,32]. The implication is clear: while these proportions offer valuable conceptual frameworks, they should be interpreted as guidelines rather than rigid rules. Aesthetic dental planning should incorporate individualized measurements, facial morphology, and patient-specific preferences to achieve optimal outcomes.

This review contributes to clinical practice by reinforcing the importance of a customized approach in esthetic dentistry. Instead of enforcing theoretical ratios, clinicians should consider dynamic and subjective components of a smile, such as lip curvature, gingival display, and facial asymmetry, which were not fully captured by the static metrics of this review [33,34]. Moreover, modern digital tools such as computer-aided smile design and AI-based esthetic planning can support a more personalized, precise, and predictable approach in achieving desired esthetic outcomes [35,36].

Although the review presents a broad and global overview of esthetic proportion theories, certain limitations are acknowledged. The studies varied in their measurement techniques, sample characteristics, and analytical approaches, which introduces potential heterogeneity. Additionally, the exclusion of studies involving orthodontically treated or restored teeth, while necessary for the integrity of natural proportion evaluation, limits the scope of the findings for restorative contexts. The reliance on cross-sectional data also precludes any understanding of how esthetic perceptions may change over time or with age. Furthermore, publication bias cannot be ruled out, as gray literature and non-indexed studies were not included.

In conclusion, while the Golden Proportion, RED Proportion, and Preston Proportion remain useful reference tools in the academic domain, they do not provide a universally applicable formula for dental esthetics. Their limited occurrence in natural dentition across different ethnicities and populations emphasizes the need for personalized esthetic assessment in clinical dentistry. The future of esthetic dentistry should move toward patient-centric protocols that balance objective proportions with individual anatomical and perceptual variability, leveraging technology and evidence-based customization to achieve truly harmonious and pleasing smiles..

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