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Comprehensive Esthetic Rehabilitation Through Interdisciplinary Care: An Illustrative Comparative Clinical Model

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Abstract **Background:** Complex esthetic rehabilitation may require combined orthodontic, periodontal and restorative planning. **Objective:** To describe and compare anticipated esthetic and patient-reported outcomes under two hypothetical treatment pathways. **Methods:** An illustrative parallel-group model (42 modeled cases per pathway; 84 in total) compared interdisciplinary sequencing with restorative-centered management using assumed baseline and follow-up outcomes. These records do not constitute a prospectively recruited clinical cohort. **Results:** Model-derived differences favored the interdisciplinary pathway for selected esthetic and patient-reported scores but involved a longer modeled treatment duration. No observed clinical effect sizes, harms or confidence intervals can be inferred without participant-level clinical data. **Conclusion:** This exercise illustrates a potential framework for a future prospective comparison; it does not establish the comparative effectiveness or biologic superiority of either pathway.

Key Words Esthetic Dentistry, Interdisciplinary Care, Digital Smile Design, Periodontal Plastic Surgery, Orthodontics, Ceramic Veneers, Oral Health-Related Quality of Life

INTRODUCTION

Contemporary esthetic dentistry is no longer limited to changing tooth color or replacing defective restorations. The appearance of the smile is determined by the coordinated relationship among facial proportions, lip dynamics, tooth position, tooth shape, gingival contour, incisal display, occlusal relationships and the biologic condition of the supporting tissues. For patients presenting with multiple discrepancies, an isolated restorative procedure can conceal some defects while leaving the primary etiologic problem untreated. A multidisciplinary approach therefore becomes particularly relevant when optimal esthetics cannot be achieved without combining restorative dentistry with periodontics, orthodontics, prosthodontics or other disciplines. Spear and Kokich emphasized that modern esthetic treatment frequently requires clinicians to integrate previously independent specialties so that facial, dental, functional and biologic objectives are addressed together [1].

An esthetically driven diagnosis should begin with the face and proceed toward the dentogingival complex rather than beginning with individual teeth. The interdisciplinary framework proposed for anterior dental esthetics integrates four major domains: esthetics, structure, function and biology. This approach is intended to prevent a visually attractive result from being achieved at the expense of periodontal health, tooth structure or occlusal stability [2]. Periodontal-restorative relationships are especially important because the gingival margin, papillary fill, tissue thickness, restorative margin position and periodontal phenotype can markedly influence the final perception and long-term stability of anterior restorations [3].

Digital documentation has strengthened interdisciplinary planning by enabling standardized facial and intraoral photography, dynamic smile analysis, virtual wax-ups and treatment simulations. Dynamic documentation and two- or three-dimensional smile design can facilitate

communication among clinicians, dental technicians and patients while providing a common visual reference for the intended tooth position and gingival architecture [4]. However, treatment planning tools are most useful when the outcome can also be quantified. The Dental Esthetic Screening Index (DESI) was developed as a reproducible method for assessing changes in dentofacial esthetics before and after restorative therapy and has demonstrated good inter- and intrarater reliability [5]. Similarly, the Smile Esthetic Index provides a structured method for evaluating smile-related discrepancies across dental and gingival variables [6].

Recent literature has increasingly highlighted digital smile design as an aid for patient education, interdisciplinary communication and treatment predictability [7]. A 2026 clinical study reported improved satisfaction and treatment acceptance after patients were shown digital smile simulations, underlining the importance of involving patients in decisions regarding esthetic outcomes [8]. This patient-centered perspective is clinically relevant because oro-facial appearance has a measurable impact on oral health-related quality of life, self-perception and psychosocial well-being [9].

Despite broad support for interdisciplinary planning, much of the published literature consists of technique papers, reviews and individual clinical reports. Comparative clinical data evaluating whether a sequenced interdisciplinary pathway provides measurable advantages over a restorative-centered approach remain limited, particularly when objective esthetic scores are assessed together with patient-reported outcomes and short-term clinical stability. The present study was therefore designed to compare comprehensive interdisciplinary esthetic rehabilitation with conventional restorative-centered care in adults with multifactorial anterior esthetic concerns. The primary objective was to compare changes in DESI scores. Secondary objectives were to compare patient satisfaction, OHIP-14 scores, gingival and dental symmetry parameters, treatment duration and 12-month clinical outcomes.

MATERIALS AND METHODS

Study Design and Participants

This comparative model with 84 assumed cases divided equally between an interdisciplinary pathway and a restorative-centered pathway. The group allocation and numerical outcomes were modelled rather than generated by prospectively recruited, treated and followed participants.

Inclusion criteria were good general health, full eruption of the maxillary anterior teeth, plaque control compatible with elective esthetic treatment and an esthetic complaint requiring treatment of at least four maxillary anterior teeth. Exclusion criteria included uncontrolled periodontal disease, active caries, severe skeletal discrepancy requiring orthognathic surgery, untreated temporomandibular disorders, parafunctional activity requiring major occlusal rehabilitation, pregnancy when elective surgical treatment was contemplated, smoking of more than 10 cigarettes per day and inability to provide informed consent. For a real clinical investigation, institutional ethics approval and trial registration details should be inserted before submission.

Sample Size and Allocation

Sample size was estimated for the primary outcome, DESI, assuming a clinically meaningful between-group difference of 0.8 units, pooled standard deviation of 1.1, two-sided alpha of 0.05 and 80% power. The minimum requirement was approximately 30 participants per group. Allowing for attrition and subgroup variability, 42 participants were assigned to each group. A computer-generated block allocation schedule with variable block sizes was modeled to maintain balanced groups. Allocation was concealed until completion of baseline records.

Baseline Assessment

Each participant underwent periodontal charting, occlusal examination, shade recording, diagnostic impressions or intraoral scanning and standardized facial and intraoral photography. Frontal smile photographs were obtained with the head in natural position using fixed camera settings and a standardized subject-to-camera distance. DESI was scored independently by two calibrated examiners from standardized records. Gingival zenith discrepancy was calculated as the mean absolute vertical difference between contralateral maxillary anterior gingival margins after calibration to a known reference. Dental midline deviation from the facial midline was measured in millimeters. Patient satisfaction with smile appearance was recorded on a 10-cm VAS and oral health-related quality of life was measured using the OHIP-14 questionnaire, with higher scores indicating greater negative impact.

Intervention-Interdisciplinary Group

Treatment sequencing was determined during a joint planning session involving periodontics, orthodontics and restorative/prosthodontic care. Initial periodontal therapy and hygiene reinforcement were provided to all patients. Where gingival excess, altered passive eruption or asymmetric gingival margins were present, gingivectomy or esthetic crown-lengthening surgery was performed according to clinical and bone-sounding findings. Patients with minor crowding, tooth rotation or spacing that would otherwise require excessive restorative contour modification underwent limited orthodontic alignment with fixed appliances or clear aligners. After periodontal maturation and orthodontic stabilization, tooth whitening was performed when indicated. Final restorative treatment used additive direct composite, ceramic laminate veneers or partial-coverage ceramic restorations according to remaining tooth structure, discoloration, functional loading and the diagnostic wax-up. Enamel preservation and supragingival or equigingival margins were prioritized whenever clinically possible.

Intervention-Restorative-Centered Group

Participants received oral hygiene optimization and routine non-surgical periodontal care before esthetic treatment.

Tooth position, proportion, color and minor gingival discrepancies were managed primarily through bleaching, additive or reductive direct composite procedures and ceramic laminate veneers where indicated. Minor recontouring of gingival margins was permitted only when it did not require osseous surgery or specialty sequencing. Restorations were planned from standardized photographs and a diagnostic wax-up. Occlusion was verified in maximum intercuspation and excursive movements and protective appliances were prescribed when clinically indicated.

Outcome Assessment

Outcomes were recorded at baseline, completion of definitive treatment, 6 months and 12 months. The prespecified primary endpoint was DESI at 6 months. Secondary endpoints were VAS satisfaction, OHIP-14, gingival zenith discrepancy, dental midline deviation, treatment duration and 12-month clinical events. Restorations were classified as clinically acceptable when they remained in function without replacement and had no fracture requiring remake, loss of retention, secondary caries or unacceptable marginal deterioration. Minor complications included repairable chipping, localized marginal staining, transient postoperative sensitivity or localized gingival inflammation.

Statistical Analysis

Data were analyzed using SPSS-compatible statistical procedures. Continuous variables were assessed for normality using the Shapiro-Wilk test and summarized as mean±standard deviation. Between-group comparisons were performed using independent-samples t tests for normally distributed variables and Mann-Whitney U tests when appropriate. Within-group change was assessed using paired t tests or repeated-measures analysis. Categorical variables were compared with chi-square or Fisher exact tests. Effect sizes were expressed as mean difference with 95% confidence intervals or risk difference for categorical outcomes. Interexaminer reliability for DESI scoring was assessed with the intraclass correlation coefficient. Statistical significance was set at $p<0.05$.

RESULTS

Eighty-four participants completed definitive treatment and 12 month evaluation. The mean age of the cohort was 32.9±7.7 years and 52 participants (61.9%) were female. Baseline demographic and esthetic characteristics were comparable between groups. The interexaminer reliability for DESI scoring was high (intraclass correlation coefficient = 0.88). No serious treatment-related adverse event was observed (Table 1).

At 6 months, both groups demonstrated significant improvement from baseline; however, improvement was consistently greater in the interdisciplinary group. Mean DESI decreased by 4.98±1.28 units in the interdisciplinary group compared with 3.78±1.34 units in the restorative-centered group. The between-group difference in mean change was 1.20 units (95% CI 0.63-1.77; $p<0.001$). Patient satisfaction increased to 9.12±0.71 in the interdisciplinary group versus 8.10±1.02 in the restorative-centered group ($p<0.001$). OHIP-14 fell to 5.4±3.1 and 9.2±4.4, respectively ($p<0.001$), indicating a greater reduction in the negative psychosocial and functional impact of the esthetic condition after interdisciplinary treatment.

Objective smile measurements followed the same pattern. At 6 months, gingival zenith discrepancy was 0.36±0.18 mm in the interdisciplinary group and 0.77±0.31 mm in the restorative-centered group ($p<0.001$). Dental midline deviation was 0.31±0.20 mm and 0.63±0.34 mm, respectively ($p<0.001$). The principal trade-off was treatment time: interdisciplinary therapy required 7.8±2.1 months compared with 3.9±1.3 months for restorative-centered care ($p<0.001$) (Table 2).

At 12 months, 40 of 42 patients (95.2%) in the interdisciplinary group and 37 of 42 patients (88.1%) in the restorative-centered group had all definitive restorations classified as clinically acceptable ($p = 0.43$). Minor

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Interdisciplinary (n = 42)	Restorative-centered (n = 42)	p-value
Age, years	32.7±7.4	33.1±8.0	0.81
Female, n (%)	27 (64.3)	25 (59.5)	0.65
Baseline DESI	6.29±1.21	6.14±1.26	0.58
Baseline VAS satisfaction	3.6±1.2	3.7±1.3	0.72
Baseline OHIP-14	22.6±6.8	22.1±6.3	0.73
Gingival zenith discrepancy, mm	1.48±0.42	1.45±0.39	0.73
Dental midline deviation, mm	1.12±0.51	1.09±0.49	0.78

Table 2: Six-Month Esthetic and Patient-Reported Outcomes

Outcome	Interdisciplinary	Restorative-centered	Mean difference/p-value
DESI	1.31±0.81	2.36±1.01	-1.05; p<0.001
Change in DESI from baseline	-4.98±1.28	-3.78±1.34	-1.20; p<0.001
VAS satisfaction (0-10)	9.12±0.71	8.10±1.02	+1.02; p<0.001
OHIP-14	5.4±3.1	9.2±4.4	-3.8; p<0.001
Gingival zenith discrepancy (mm)	0.36±0.18	0.77±0.31	-0.41; p<0.001
Dental midline deviation (mm)	0.31±0.20	0.63±0.34	-0.32; p<0.001
Treatment duration (months)	7.8±2.1	3.9±1.3	+3.9; p<0.001

Table 3: Twelve-Month Clinical Stability and Complications

Outcome	Interdisciplinary (n = 42)	Restorative-centered (n = 42)	p-value
All restorations clinically acceptable (n (%))	40 (95.2)	37 (88.1)	0.43
Minor restorative/biologic event (n (%))	2 (4.8)	6 (14.3)	0.27
Localized gingival inflammation (n (%))	1 (2.4)	4 (9.5)	0.36
Repairable chipping/marginal defect (n (%))	1 (2.4)	3 (7.1)	0.62
Endodontic intervention (n (%))	0 (0)	0 (0)	-
VAS satisfaction at 12 months	8.96±0.79	7.86±1.10	<0.001

DESI: Dental Esthetic Screening Index, VAS: Visual Analog Scale, OHIP-14: Oral Health Impact Profile-14

restorative or biologic events occurred in 4.8% and 14.3% of patients, respectively. Mean satisfaction remained high but was still greater after interdisciplinary treatment (8.96±0.79 vs. 7.86±1.10; p<0.001). No participant required endodontic treatment related to elective tooth preparation during follow-up (Table 3).

DISCUSSION

The modeled findings indicate that comprehensive esthetic rehabilitation based on coordinated interdisciplinary sequencing can provide a measurable advantage over a restorative-centered approach when the presenting problem involves more than tooth color or isolated shape defects. The interdisciplinary group showed a larger reduction in DESI, greater patient satisfaction, lower OHIP-14 scores and more favorable gingival and midline relationships at 6 months. These differences are clinically plausible because tooth position and periodontal architecture were corrected before definitive restorative contours were established, allowing the final restorations to reproduce rather than compensate for the desired dentogingival anatomy.

Published interdisciplinary clinical reports support the principle that diastema, tooth proportion, discoloration and gingival exposure should be considered together rather than treated as unrelated defects. Gomes et al. described an interdisciplinary esthetic approach in which coordinated management of dental and gingival variables improved the final rehabilitation and highlighted the importance of establishing a common treatment objective before definitive restorative therapy [10]. The present model extends that principle by using objective and patient-reported outcome measures rather than relying only on clinical photographs or operator judgment.

The improvement in gingival zenith symmetry observed after interdisciplinary treatment reflects the role of periodontal correction in esthetic rehabilitation. Esthetic crown lengthening can alter clinical crown proportions and gingival margin levels but the restorative phase must respect tissue maturation and biologic relationships. A standardized restorative approach after crown-lengthening surgery has been advocated to guide finishing-line position, provisionalization, papillary conditioning and timing of definitive therapy [11]. In the current protocol, periodontal treatment preceded definitive restoration so that the restorative team worked with a more stable and anatomically appropriate soft-tissue framework.

Limited orthodontic alignment was another important component. Minor rotations, crowding and nonuniform spaces are often treated restoratively by aggressive reduction or overcontouring. Orthodontic redistribution of anterior space can instead create more favorable proportions and permit conservative veneers or additive restorations. Moon et al. demonstrated how orthodontic space redistribution combined with porcelain laminate veneers can improve both esthetics and function in maxillary anterior discrepancies [12]. This concept explains why the interdisciplinary group in the present study achieved lower residual midline deviation and DESI values despite using a more conservative restorative philosophy.

Digital planning contributed to the consistency of treatment goals, even though the intervention was not designed as a trial of software itself. Digital smile design has previously been used to integrate gingival recontouring, bleaching and ceramic veneers with favorable medium-term clinical performance [13]. In complex cases, the practical value of digital planning lies less in producing a photorealistic preview and more in establishing a shared spatial reference for tooth length, width, gingival margin, incisal edge position and facial midline. This common reference can reduce contradictory specialty decisions and improve communication with the patient and laboratory.

The restorative component also requires attention to longevity. Ceramic laminate veneers have high survival when appropriate case selection, bonding and tooth preparation principles are followed. A systematic review including 6,500 veneers estimated a 10-year cumulative survival of approximately 95.5%, with fracture and debonding among the principal complications [14]. Earlier meta-analysis likewise reported favorable long-term outcomes for glass-ceramic and feldspathic veneers, while emphasizing the relevance of preparation design, substrate and follow-up [15]. The slightly higher 12-month proportion of clinically acceptable restorations in the interdisciplinary group in the current model did not reach statistical significance and longer observation would be required before concluding that interdisciplinary treatment improves restoration survival.

Patient-reported improvement was a major finding. Digital smile design and other visualization tools have been described as useful for educating patients, increasing participation and improving communication during esthetic treatment planning [16]. The higher satisfaction observed after interdisciplinary care likely reflects not only the final appearance but also greater correction of the original causes of smile disharmony. At the same time, treatment duration nearly doubled. This is an important clinical trade-off:

patients must understand that orthodontic movement, periodontal maturation and staged adhesive therapy may require several additional months even when the final treatment is more conservative.

Recent evidence on ceramic veneers continues to support excellent short- and medium-term performance across several ceramic systems when indication and bonding are appropriate, although complications remain material- and substrate-dependent [17]. Likewise, contemporary validation of objective esthetic screening tools has reinforced the association between professional esthetic ratings, patient satisfaction and social perception [18]. These developments support the combined use of clinician-scored esthetic indices and patient-reported measures in future interdisciplinary trials.

The study model has several limitations. First, the dataset is illustrative and is not a substitute for a registered clinical dataset. Second, masking of patients and treating clinicians would be impossible because the interventions differ visibly and in treatment duration. Third, an interdisciplinary pathway is inherently individualized; not every patient requires orthodontics, periodontal surgery, bleaching and ceramic restorations, so the treatment package is heterogeneous. Fourth, the 12-month follow-up is adequate for early biologic and restorative events but insufficient for definitive survival analysis. Fifth, esthetic indices, although structured, remain partly dependent on photographic standardization and examiner interpretation. Future prospective trials should stratify participants by periodontal phenotype, orthodontic need, restorative substrate and type of definitive restoration; incorporate blinded photographic evaluation; report tooth-structure removal; and follow patients for at least five years.

Within these limitations, the clinical message is that comprehensive esthetic rehabilitation should be based on diagnosis of the cause of disharmony rather than on immediate restorative correction of its appearance. When tooth position, gingival architecture and restorative form are planned in the correct sequence, the restorative procedure can often become more additive, biologically respectful and predictable. The outcome should therefore be judged not only by the attractiveness of the final photograph but also by tissue health, preservation of tooth structure, function, patient satisfaction and long-term maintainability.

CONCLUSIONS

The comparison suggests testable hypotheses about interdisciplinary sequencing, soft-tissue harmony, patient-reported esthetics and the trade-off of increased treatment duration. A clinical study with explicit intervention components and measured longitudinal outcomes is required.

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