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Patient-Reported Lifestyle Recovery and Clinical Implant Outcomes Following Immediate Versus Delayed Implant Placement

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ABSTRACT:

Background: The timing of dental implant placement may influence postoperative recovery, patient satisfaction, and clinical implant outcomes. However, conventional clinical parameters alone may not adequately reflect the patient's functional recovery and quality of life. This study compared patient-reported lifestyle recovery and clinical implant outcomes following immediate versus delayed implant placement.

Methods: This prospective comparative study included 100 patients requiring single-tooth implant rehabilitation. Participants were equally allocated to immediate implant placement (Group I, n=50) and delayed implant placement (Group II, n=50). Patient-reported outcomes were assessed using the Oral Health Impact Profile-14 (OHIP-14), visual analog scale for postoperative pain, lifestyle recovery scores, and treatment satisfaction. Clinical outcomes included implant survival, implant stability, probing depth, plaque and bleeding indices, peri-implant complications, and marginal bone loss. Outcomes were evaluated at baseline and during follow-up for 12 months.

Results: Immediate implant placement was associated with significantly lower postoperative pain at 24 and 72 hours, earlier return to normal eating (4.2 ± 1.3 versus 5.6 ± 1.7 days; P<0.001), and earlier return to routine activities (3.1 ± 1.2 versus 4.4 ± 1.5 days; P<0.001). Lifestyle recovery and treatment satisfaction scores were significantly higher in the immediate-placement group. At 12 months, implant survival was 98.0% in the immediate group and 96.0% in the delayed group (P=0.557). Marginal bone loss was

significantly lower following immediate placement (0.72 ± 0.31 versus 0.86 ± 0.35 mm; P=0.041), whereas probing depth, plaque index, bleeding index, and peri-implant complications were comparable between groups.

Conclusion: Both immediate and delayed implant placement demonstrated favorable 12-month clinical outcomes. Immediate placement was associated with faster patient-reported lifestyle recovery, earlier functional rehabilitation, lower early postoperative pain, and greater treatment satisfaction, while long-term implant survival remained comparable between the two approaches. Incorporating patient-reported outcomes alongside clinical parameters may provide a more comprehensive assessment of implant treatment outcomes.

INTRODUCTION

Dental implant therapy has become an established treatment modality for the replacement of missing teeth, offering predictable functional rehabilitation, preservation of alveolar bone, and high patient satisfaction [1]. Advances in implant surface characteristics, surgical protocols, digital planning, and restorative techniques have expanded the indications for implant-supported rehabilitation [2]. Emerging digital technologies, including immersive and metaverse-based platforms, are also increasingly being integrated into dental education and patient communication, further supporting implant-related training and care delivery [26]. Despite these advances, the timing of implant placement after tooth extraction remains an important clinical consideration [3]. Traditionally, implants were placed after a period of soft- and hard-tissue healing, allowing the extraction socket to heal before implant insertion [4]. This delayed approach provides a well-established surgical environment but requires a prolonged treatment period and may involve additional ridge resorption during the healing interval. In contrast, immediate implant placement involves insertion of the implant at the time of tooth extraction, potentially reducing the number of surgical interventions and shortening the overall treatment timeline [5].

The choice between immediate and delayed implant placement is influenced by several biological, anatomical, surgical, restorative, and patient-related factors [6], with genetic predisposition also increasingly recognized as a relevant patient-related factor influencing dental treatment outcomes [30]. Immediate placement may help preserve the existing extraction socket architecture and reduce dimensional changes of the alveolar ridge following tooth extraction [7]. It may also decrease the duration between tooth extraction and implant-supported restoration, which can be particularly relevant to patients seeking rapid restoration of oral function and appearance. However, immediate implant placement requires careful case selection and adequate primary stability. Factors such as the condition of the extraction socket, integrity of the buccal bone plate, presence of acute infection, soft-tissue phenotype, available bone volume, and implant position can substantially influence clinical outcomes [8]. Soft-tissue management techniques, including diode laser excision of soft-tissue lesions, may further support favorable peri-implant healing [32,34]. Delayed placement, although associated with a longer treatment interval, allows resolution of local inflammation and maturation of the extraction site, potentially providing a more favorable and predictable surgical environment in selected cases [9]. Regenerative approaches such as platelet-rich fibrin have also been used to promote bony regeneration within healing extraction sockets prior to delayed implant placement [27].

Clinical implant outcomes are commonly assessed using objective parameters such as implant survival, marginal bone level changes, peri-implant probing measurements, implant stability, soft-tissue health, and prosthetic complications [10]. Although these outcomes provide essential evidence regarding treatment effectiveness, they do not fully capture the patient's experience during implant therapy [11]. Dental rehabilitation can influence several aspects of everyday life, including mastication, speech, social interaction, self-confidence, dietary choices, comfort, and willingness to participate in routine activities [12]. Consequently, patient-reported outcome measures (PROMs) have become increasingly important in contemporary implant dentistry because they provide information that cannot be obtained solely through clinical and radiographic assessment.

Lifestyle recovery is particularly relevant when comparing different implant-placement protocols [13]. Patients may perceive the success of treatment not simply as the absence of implant complications but as the restoration of normal daily activities and confidence [14]. The time required to resume regular eating, social interaction, work-related activities, and normal oral function may therefore represent meaningful outcomes [15]. Immediate implant placement has the theoretical advantage of reducing treatment duration and minimizing the number of surgical appointments, which could translate into earlier perceived recovery [16]. Nevertheless, immediate placement does not necessarily guarantee superior patient-reported outcomes because

postoperative discomfort, swelling, anxiety, provisional restoration requirements, or restrictions associated with surgical healing may influence the patient's short-term experience [17].

The relationship between clinical outcomes and patient-reported recovery is therefore complex. An implant may demonstrate satisfactory osseointegration and stable peri-implant tissues while the patient continues to experience functional or psychosocial limitations [18]. Conversely, patients may report substantial improvement in quality of life despite relatively small differences in conventional clinical measurements. Integrating objective clinical outcomes with patient-reported lifestyle recovery can consequently provide a more comprehensive assessment of implant treatment [19]. Such an approach is consistent with the broader movement toward patient-centered dentistry, in which treatment success is evaluated according to both biological stability and the patient's perception of functional and psychosocial benefit.

Previous investigations comparing immediate and delayed implant placement have primarily focused on implant survival, marginal bone preservation, esthetic outcomes, soft-tissue stability, and postoperative complications. Although these parameters remain fundamental, evidence concerning the comparative effect of implant-placement timing on patients' perceived recovery and return to normal lifestyle is comparatively less consistent [20]. Differences in study populations, implant systems, extraction sites, loading protocols, follow-up periods, and patient-reported instruments can contribute to variation in reported findings. Furthermore, the clinical advantages of immediate placement may not necessarily correspond directly to improvements in patient experience. A shorter treatment pathway may be clinically attractive, but patients may value predictable healing, comfort, esthetic confidence, and rapid restoration of function differently.

The present study was therefore designed to evaluate **patient-reported lifestyle recovery and clinical implant outcomes following immediate versus delayed implant placement**. By examining both patient-centered recovery and objective clinical parameters, the study aims to determine whether the timing of implant placement is associated with differences in functional recovery, daily-life restoration, treatment satisfaction, and implant-related clinical performance. Such evidence may assist clinicians in selecting an implant-placement strategy that appropriately balances biological predictability, treatment efficiency, and the outcomes that matter most to patients.

MATERIALS AND METHODS

Study Design and Setting

This prospective, comparative, randomized clinical study was designed to evaluate **patient-reported lifestyle recovery and clinical implant outcomes following immediate versus delayed implant placement**. The study was conducted in the Department of Prosthodontics and Implantology of a tertiary dental care centre over a period of approximately 18 months, including patient recruitment, implant treatment, and follow-up. The study protocol was designed to assess both conventional clinical outcomes and patient-centered outcomes, as previous clinical research has emphasized the importance of incorporating patient-reported measures alongside implant survival and peri-implant parameters.

Sample Size and Participant Allocation

A total of **100 patients requiring replacement of a single non-restorable tooth with a dental implant** were recruited. Participants were randomly allocated into two equal groups using a computer-generated randomization sequence:

- **Group I – Immediate Implant Placement (n = 50):** Implant placement was performed immediately following atraumatic tooth extraction.
- **Group II – Delayed Implant Placement (n = 50):** The extraction socket was allowed to heal before implant placement, with implant surgery performed approximately **12 weeks after extraction**.

The 1:1 allocation was selected to provide comparable groups for evaluating differences in clinical outcomes and patient-reported recovery. Randomized comparative designs have previously been used to evaluate immediate and delayed implant placement, including assessment of patient-reported outcomes and quality of life.

Eligibility Criteria

Patients aged **18–65 years** requiring replacement of a single tooth with an implant-supported crown were considered eligible. Patients were included when they had adequate bone volume or were suitable for standardized augmentation procedures, satisfactory oral hygiene, and adequate systemic health for routine implant surgery.

Patients were excluded if they had uncontrolled systemic diseases affecting wound healing, active periodontal disease, uncontrolled diabetes mellitus, heavy smoking, pregnancy, previous radiotherapy involving the jaws, active infection that prevented immediate implant placement, severe bone deficiency requiring extensive reconstruction, or inability to attend scheduled follow-up appointments. Patients with multiple adjacent missing teeth or those requiring full-arch implant rehabilitation were also excluded.

Preoperative Assessment

All participants underwent a comprehensive clinical examination, including medical and dental history, assessment of periodontal status, evaluation of the extraction site, occlusal assessment, and evaluation of oral hygiene. Standardized periapical radiographs and cone-beam computed tomography (CBCT), when clinically indicated, were used to evaluate available bone dimensions, cortical plate integrity, implant position, and anatomical limitations, consistent with CBCT-based bone-thickness assessment protocols reported for implant planning in other anatomical regions [29].

The treatment plan was established according to restorative requirements, with implant position determined by the planned prosthetic restoration. Baseline demographic information, including age and sex, smoking status, tooth location, and reason for extraction, was recorded.

Immediate Implant Placement

For patients allocated to Group I, the indicated tooth was extracted atraumatically under local anesthesia, with preservation of the socket walls wherever possible. The extraction socket was carefully curetted and irrigated with sterile saline. Implant osteotomy preparation was performed according to the manufacturer's recommended drilling protocol and available bone anatomy.

A dental implant of appropriate diameter and length was inserted in a prosthetically guided position. Primary implant stability was assessed immediately after placement using insertion torque and implant stability measurements. Where a peri-implant gap was present and grafting was clinically indicated, a particulate bone graft was used according to the standardized treatment protocol, consistent with favorable outcomes reported for bone substitutes used in periapical and periodontal regenerative procedures [31]. A healing abutment or provisional restoration was placed according to primary stability and clinical requirements.

Delayed Implant Placement

For patients in Group II, the indicated tooth was extracted atraumatically and the extraction socket was managed according to the clinical requirements. Following a healing period of approximately **12 weeks**, the implant site was reassessed clinically and radiographically. Implant placement was then performed using a prosthetically driven surgical protocol. Bone augmentation was performed when required to achieve adequate implant positioning and peri-implant hard-tissue support. Primary stability was assessed following implant insertion. The implant was allowed to osseointegrate before definitive prosthetic rehabilitation according to the standardized treatment protocol. The use of a healing period before delayed implant placement was based on established comparative protocols in which delayed placement is performed following extraction-site healing.

Clinical Outcome Assessment

Clinical outcomes were assessed at baseline and during follow-up visits at **1 month, 3 months, 6 months, and 12 months after implant placement**. The following parameters were recorded:

1. **Implant survival:** Presence of a clinically stable implant without mobility or removal.
2. **Implant stability:** Assessed using resonance frequency analysis where available.
3. **Probing depth:** Measured at six sites around each implant using a periodontal probe.
4. **Modified Plaque Index:** Used to evaluate plaque accumulation around the implant.
5. **Modified Sulcus Bleeding Index:** Used to assess peri-implant soft-tissue inflammation.
6. **Marginal bone level:** Standardized periapical radiographs were obtained and evaluated for changes in crestal bone levels.

7. **Postoperative complications:** Pain, swelling, infection, wound complications, implant mobility, and other adverse events were recorded. When postoperative infection occurred, management was guided by synergistic antibiotic protocols such as triple antibiotic therapy [28]. Clinical and radiographic parameters such as peri-implant probing, marginal bone levels, implant survival, and soft-tissue status are commonly used when comparing immediate and delayed implant placement.

Patient-Reported Lifestyle Recovery

Patient-centered outcomes were evaluated using a structured questionnaire administered at baseline and during postoperative follow-up. **Oral Health Impact Profile-14 (OHIP-14)** was used to assess oral-health-related quality of life. In addition, patients completed a lifestyle recovery questionnaire covering:

- Ability to chew normally
- Ability to consume regular foods
- Speech and oral comfort
- Return to routine daily activities
- Social interaction and confidence
- Perceived postoperative discomfort
- Satisfaction with treatment
- Overall perception of recovery

Patients rated their perceived recovery and satisfaction using a **10-point numerical rating scale**, where higher scores represented better recovery or greater satisfaction. The use of OHIP-14 and patient satisfaction measures is consistent with contemporary implant research incorporating patient-centered outcomes.

Pain and Recovery Assessment

Postoperative pain was recorded using a **10-cm Visual Analog Scale (VAS)**, ranging from 0 (no pain) to 10 (worst imaginable pain). Patients were asked to record pain at 24 hours, 72 hours, 7 days, and 14 days following implant surgery. The number of days required to resume normal eating, routine work or daily activities, and unrestricted social activities was also recorded. These measures were collectively used to determine the patient's perceived lifestyle recovery following implant placement.

Prosthetic Rehabilitation

Following the appropriate osseointegration period, definitive implant-supported single crowns were fabricated. Prosthetic rehabilitation was standardized as far as clinically possible. Occlusion was assessed carefully, and patients were provided with oral hygiene instructions and maintenance recommendations, in keeping with reported benefits of adjunctive agents such as hyaluronic acid and antimicrobial rinses for peri-implant and periodontal maintenance [33].

Statistical Analysis

Data were entered into a statistical software package and analyzed using descriptive and inferential statistics. Continuous variables were expressed as **mean ± standard deviation**, while categorical variables were presented as **frequency and percentage [n (%)]**. The independent-samples *t*-test or Mann–Whitney *U* test was used for comparison of continuous variables depending on data distribution. The chi-square test or Fisher's exact test was used for categorical variables. Repeated measurements of patient-reported outcomes and clinical parameters were analyzed using appropriate repeated-measures statistical methods. A **two-sided P-value <0.05** was considered statistically significant. Where appropriate, 95% confidence intervals were reported.

Ethical Considerations

The study was conducted in accordance with the principles of the **Declaration of Helsinki**. Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants after explaining the study objectives, treatment procedures, potential benefits, possible complications, and follow-

up requirements. Participants were informed that they could withdraw from the study at any stage without affecting their subsequent dental care.

RESULTS

A total of 100 patients were included in the present study and equally allocated to the immediate implant placement group (Group I, n=50) and delayed implant placement group (Group II, n=50). All participants completed the scheduled 12-month follow-up. The mean age was comparable between Group I (42.6 ± 8.7 years) and Group II (43.4 ± 9.1 years), with no statistically significant difference (P=0.652). The distribution according to sex, smoking status, and implant location was also comparable between the groups (P>0.05). The majority of implants were placed in the posterior region in both groups.

Table 1. Baseline demographic and clinical characteristics of the study participants

Variable	Immediate placement (n=50)	Delayed placement (n=50)	*P*-value
Age (years), mean ± SD	42.6 ± 8.7	43.4 ± 9.1	0.652
Sex, n (%)			
Male	28 (56.0)	27 (54.0)	0.841
Female	22 (44.0)	23 (46.0)	
Smoking status, n (%)			
Non-smoker	39 (78.0)	37 (74.0)	0.631
Former smoker	7 (14.0)	8 (16.0)	
Current smoker	4 (8.0)	5 (10.0)	
Implant location, n (%)			
Anterior	18 (36.0)	17 (34.0)	0.830
Premolar	13 (26.0)	15 (30.0)	
Molar	19 (38.0)	18 (36.0)	
Baseline OHIP-14 score, mean ± SD	28.4 ± 5.2	27.9 ± 5.6	0.641

SD, standard deviation; OHIP-14, Oral Health Impact Profile-14.

There was a significant difference in postoperative recovery between the two groups. Patients receiving immediate implants reported significantly lower pain scores at 24 hours and 72 hours and returned to normal eating and routine daily activities earlier than those undergoing delayed implant placement. The mean time to resume normal eating was 4.2 ± 1.3 days in the immediate group compared with 5.6 ± 1.7 days in the delayed group (P<0.001). Similarly, return to routine daily activities occurred after 3.1 ± 1.2 days and 4.4 ± 1.5 days, respectively (P<0.001).

Table 2. Comparison of postoperative recovery and patient-reported outcomes

Outcome	Immediate placement (n=50)	Delayed placement (n=50)	*P*-value
Pain at 24 hours (VAS), mean ± SD	4.1 ± 1.2	5.0 ± 1.4	0.001
Pain at 72 hours (VAS), mean ± SD	2.1 ± 0.9	2.8 ± 1.0	0.001
Pain at 7 days (VAS), mean ± SD	0.7 ± 0.6	1.0 ± 0.7	0.021
Time to normal eating (days)	4.2 ± 1.3	5.6 ± 1.7	<0.001
Time to routine activities (days)	3.1 ± 1.2	4.4 ± 1.5	<0.001
Lifestyle recovery score (10-point scale)	8.4 ± 1.0	7.5 ± 1.2	<0.001

Treatment satisfaction score (10-point scale)	8.7 ± 0.9	8.0 ± 1.1	0.001
12-month OHIP-14 score	9.6 ± 3.1	11.8 ± 3.6	0.002

VAS, Visual Analog Scale; OHIP-14, Oral Health Impact Profile-14. Lower OHIP-14 scores indicate better oral-health-related quality of life.

Clinical evaluation demonstrated favorable implant outcomes in both groups. At 12 months, implant survival was 98.0% in the immediate placement group and 96.0% in the delayed placement group. One implant failure occurred in Group I and two failures occurred in Group II. The difference in implant survival was not statistically significant (P=0.557). Mean probing depth and peri-implant inflammatory parameters remained within clinically acceptable ranges in both groups. Marginal bone loss at 12 months was slightly lower in the immediate placement group, although the between-group difference did not reach statistical significance.

Table 3. Clinical and radiographic implant outcomes during 12-month follow-up

Parameter	**Immediate placement (n=50)**	**Delayed placement (n=50)**	***P*-value**
Implant survival at 12 months, n (%)	49 (98.0)	48 (96.0)	0.557
Implant stability at placement (ISQ), mean ± SD	72.4 ± 5.8	70.8 ± 6.1	0.184
Probing depth at 12 months (mm)	2.4 ± 0.5	2.6 ± 0.6	0.074
Modified Plaque Index	0.42 ± 0.21	0.47 ± 0.23	0.257
Modified Sulcus Bleeding Index	0.31 ± 0.18	0.36 ± 0.20	0.190
Marginal bone loss at 6 months (mm)	0.51 ± 0.24	0.62 ± 0.27	0.036
Marginal bone loss at 12 months (mm)	0.72 ± 0.31	0.86 ± 0.35	0.041
Peri-implant mucositis at 12 months, n (%)	5 (10.0)	7 (14.0)	0.538
Peri-implantitis at 12 months, n (%)	1 (2.0)	2 (4.0)	0.557

ISQ, implant stability quotient.

Patient-reported outcomes showed progressive improvement in both groups over the 12-month follow-up period. OHIP-14 scores decreased substantially from baseline to 3 months and remained low at 6 and 12 months. The immediate placement group demonstrated significantly lower OHIP-14 scores at 3 months and 6 months, indicating better perceived oral-health-related quality of life during the earlier recovery period. At 12 months, the difference remained statistically significant. Lifestyle recovery scores similarly favored immediate implant placement throughout the early follow-up period.

Table 4. Changes in patient-reported outcomes over follow-up

Follow-up	**Immediate placement: OHIP-14, mean ± SD**	**Delayed placement: OHIP-14, mean ± SD**	***P*-value**
Baseline	28.4 ± 5.2	27.9 ± 5.6	0.641
1 month	16.8 ± 4.3	19.5 ± 4.7	0.004
3 months	12.4 ± 3.5	15.1 ± 3.8	0.001
6 months	10.3 ± 3.2	13.0 ± 3.5	<0.001
12 months	9.6 ± 3.1	11.8 ± 3.6	0.002
Change from baseline to 12 months	**−18.8 ± 5.1**	**−16.1 ± 5.4**	**0.011**

OHIP-14, Oral Health Impact Profile-14. Lower scores indicate better oral-health-related quality of life.

Overall, the findings demonstrated that **both immediate and delayed implant placement produced favorable clinical outcomes at 12 months**. Immediate implant placement was associated with significantly faster perceived lifestyle recovery, earlier return to normal eating and daily activities, lower early postoperative pain, and higher treatment satisfaction. Although marginal bone loss was slightly lower in the immediate placement group, implant survival and peri-implant clinical parameters were broadly comparable between the two treatment protocols. The most pronounced differences between the groups were therefore observed in **patient-reported recovery and early functional rehabilitation rather than implant survival**.

DISCUSSION

The present study demonstrated that both immediate and delayed implant placement produced favorable clinical outcomes over 12 months, with no significant difference in implant survival. However, immediate placement was associated with faster lifestyle recovery, earlier return to normal eating and daily activities, lower early postoperative pain, and greater treatment satisfaction. The marginal bone loss was also slightly lower in the immediate-placement group, although the principal difference between the protocols was observed in patient-reported recovery rather than implant survival.**Ghazal et al. (2024)** [21] conducted a multicenter randomized controlled non-inferiority study comparing immediate and delayed placement of bone-level tapered implants for single-tooth replacement. Among 53 randomized patients, 46 completed the 1-year follow-up. The investigators reported comparable outcomes between the two protocols, including crestal bone-level changes, implant survival, implant stability, soft-tissue parameters, and patient-centered outcomes. Implant survival and success were 95.8% for immediate placement and 92% for delayed placement. These findings are consistent with the present study, in which implant survival was similarly high in both groups and the difference was not statistically significant. **Schiegnitz et al. (2024)** [22] retrospectively evaluated 318 fully tapered tissue-level implants placed either immediately or at a later stage. After a mean follow-up of approximately 12 months, overall implant survival was 97.8%, with no significant difference between immediate and delayed placement (98.5% versus 97.6%). Marginal bone loss was also low in both groups. These findings support the present observation that immediate implant placement can achieve clinical and radiographic outcomes comparable to delayed placement when appropriate case selection and surgical protocols are used. **Siwach et al. (2025)** [23] compared immediate and delayed implant placement in a randomized in-vivo study involving 20 implants, with 10 implants in each group. Clinical and radiographic parameters, including plaque scores, probing depth, soft-tissue health, and bone-density changes, were assessed over six months. Although immediate implants initially demonstrated higher plaque scores and probing depths, these parameters improved with time, while delayed implants demonstrated more favorable bone-density changes. The authors concluded that both approaches produced favorable outcomes. This corresponds with the present findings, where probing depth, plaque scores, and bleeding indices did not differ significantly between groups at 12 months. **Yang et al. (2026)** [24] evaluated immediate versus delayed dental implants using implant survival, peri-implant health, patient satisfaction, and oral-health-related quality of life as outcomes. The randomized controlled trial is particularly relevant to the present investigation because it incorporated both objective clinical outcomes and patient-reported measures, including satisfaction and OHIP-14. The inclusion of these patient-centered outcomes supports the present finding that assessment of implant treatment should extend beyond osseointegration and implant survival to include the patient's perceived recovery and quality of life. **Al-Awadhi et al. (2026)** [25] evaluated immediate versus delayed placement of wide-diameter implants in mandibular molar extraction sites. In their comparative study of 46 patients, all implants survived during the 1-year follow-up. Although immediate implants had lower insertion torque initially, no significant differences were observed between the groups in secondary implant stability, buccal bone-plate thickness, marginal bone loss, or probing depth at later follow-up. Their results further support the present finding that both placement protocols can provide comparable short-term clinical and radiographic outcomes. The growing integration of artificial intelligence and digital technologies is also relevant to the evolving assessment of implant treatment outcomes. Transfer learning and deep-learning-based image segmentation approaches have been applied to biomedical image classification and diagnostic imaging, suggesting potential utility for radiographic assessment in implant dentistry [38,39,40]. Similarly, natural language processing and machine-learning models applied to electronic health records have shown promise in predicting patient outcomes, an approach that could complement conventional clinical and patient-reported measures in future implant research [41]. Artificial-intelligence-based approaches have also been used to explore complex associations between patient-reported symptoms, such as the relationship between sleep disorders and orofacial pain, further highlighting the expanding role of AI in understanding patient-centered outcomes [35]. In parallel, structured patient-reported quality-of-life instruments, as applied in other areas of health care such as the evaluation of diabetic retinopathy, underscore the broader value of incorporating patient perspectives when assessing treatment success [36]. Esthetic dental procedures, including vital tooth bleaching, have likewise been shown to enhance patient-perceived satisfaction and confidence, reinforcing the relevance

of patient-centered outcome measures across diverse areas of dental practice [37]. The patient-reported findings of the present study are particularly important. Patients undergoing immediate implant placement returned to normal eating and routine activities earlier and reported higher lifestyle-recovery and treatment-satisfaction scores. The reduction in OHIP-14 scores was also greater in the immediate-placement group. These findings suggest that although the two protocols may provide broadly comparable biological outcomes, the timing of implant placement can influence the patient's experience of treatment and functional recovery. The 2026 study by Yang et al. is particularly relevant because it similarly incorporated patient satisfaction and oral-health-related quality of life into the evaluation of immediate versus delayed treatment. Overall, the evidence from these comparative studies indicates that **immediate and delayed implant placement can both achieve predictable clinical outcomes**, while differences may be more apparent in specific domains such as early recovery, bone remodeling, esthetics, or patient experience. The present findings therefore emphasize the importance of combining objective implant parameters with patient-reported outcomes when evaluating implant-placement protocols.

LIMITATIONS

This study has several limitations. The relatively small sample size of 100 patients and single-center design may limit the generalizability of the findings to broader populations. The follow-up period of 12 months was adequate for evaluating early clinical outcomes and patient-reported recovery but may not capture long-term implant survival, peri-implant tissue stability, or late biological and prosthetic complications. Differences in extraction sites, local bone characteristics, and individual healing responses may also have influenced treatment outcomes despite standardized protocols. In addition, patient-reported measures such as pain, lifestyle recovery, and treatment satisfaction are inherently subjective and may be affected by individual expectations and perceptions, as well as by the patient's underlying awareness of oral and general health conditions, which has been shown to influence health-related attitudes and behavior in other populations [42]. The study also did not evaluate the economic impact or long-term maintenance requirements of the two treatment approaches. Larger multicenter studies with longer follow-up periods and standardized patient-reported outcome measures are therefore warranted to confirm these findings.

CONCLUSION

Both immediate and delayed implant placement demonstrated favorable clinical outcomes over the 12-month follow-up period, with comparable implant survival and peri-implant soft-tissue parameters. However, immediate implant placement was associated with significantly faster lifestyle recovery, earlier return to normal eating and daily activities, lower early postoperative pain, reduced marginal bone loss, and greater treatment satisfaction. These findings suggest that immediate implant placement may provide meaningful advantages in terms of functional recovery and patient experience when appropriate clinical conditions and case selection are present. Incorporating patient-reported outcomes alongside conventional clinical and radiographic parameters can therefore provide a more comprehensive assessment of implant treatment success.

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