Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine

Clinical Trial Protocol

Item	Content
Protocol title	Comparison of a Novel Collagen Matrix and Connective Tissue Graft for Soft Tissue Augmentation in Conjunction with Immediate Implant Placement in the Maxillary Anterior Region: A Randomized Controlled Clinical Trial
Version No.	1.1
Version date	January 8, 2026
Principal Investigator	Lai Hongchang
Planned study period	November 2026 – January 2028

Investigator Statement and Protocol Signature Page

As the Principal Investigator of this study, I will conduct the study in accordance with the ethical principles of the Measures for the Ethical Review of Biomedical Research Involving Humans (National Health and Family Planning Commission Order No. 11 of 2016), the Measures for the Ethical Review of Research Involving Human Life Science and Medicine (Guo Wei Ke Jiao Fa [2023] No. 4), and Good Clinical Practice (GCP), using the protocol approved by the Ethics Committee, and will carry out the study in accordance with the requirements of this protocol, so as to ensure the scientific validity of the research and to protect the health and rights of the participants.

Name: Lai Hongchang

Date: January 8, 2026

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Appendix 1: Clinical Trial Flow Chart

1. Protocol Summary

Item	Content
Protocol title	Comparison of a Novel Collagen Matrix and Connective Tissue Graft for Soft Tissue Augmentation in Conjunction with Immediate Implant Placement in the Maxillary Anterior Region: A Randomized Controlled Clinical Trial
Version No. / date	Version 1.1, January 8, 2026
Sponsor and participating institution	Department of Oral Implantology, Shanghai Ninth People's Hospital, Shanghai Jiao Tong

Item	Content
	University School of Medicine
Study nature	Randomized controlled clinical trial
Sample size	46
Objective	To compare the novel collagen matrix with connective tissue grafting with respect to soft tissue augmentation outcomes, patient-reported outcomes, wound healing parameters, and esthetic outcomes in implant-supported fixed rehabilitation.
Study population	Patients aged 18–80 years (inclusive) with a single maxillary anterior tooth requiring immediate implant placement
Study design	Randomized controlled trial
Inclusion criteria	Intact labial bone wall (< 1 mm) or thin gingival biotype at the immediate implant site; absence of labial contour concavity; healthy adjacent and opposing teeth; sufficient mesiodistal space and occlusal clearance; intact labial bone wall after minimally traumatic tooth extraction; voluntary participation with signed informed consent
Exclusion criteria	Uncontrolled severe periodontitis; heavy smokers (> 10 cigarettes/day); other patients judged by the investigator to be unsuitable for immediate implant placement
Study timeline	December 2025 – January 2026: ethics submission and study registration completed; February 2026 – December 2026: screening, enrollment, randomization, and treatment of the 46 eligible participants completed; January 2027 – June 2027: delivery of the definitive prostheses for all participants completed; July 2027 – December 2027: (1) completion of data cleaning and analysis of all follow-up data; (2) completion of manuscript preparation and publication

Item	Content
Statistical analysis	Data management and statistical analysis will be performed using SPSS 20.0. Normally distributed continuous data will be described as mean ± standard deviation and compared with parametric tests (independent-samples t test). Non-normally distributed continuous data will be described with medians and compared using non-parametric tests (Wilcoxon rank-sum test).
Publication of results	The results will be published in international peer-reviewed journals
Principal Investigator	Lai Hongchang (赖红昌), Professor, born November 10, 1966

Key members of the study team

Name	Date of birth	Title	GCP certificate	Role in the study
Shi Junyu	May 1989	Associate Chief Physician	Yes	Surgery
Fu Xiaojiao	May 1994	Attending Physician	Yes	Study implementation
Lv Xiaolei	September 1994	Physician	No	Case collection
Wu Jicenyuan	March 1999	Graduate student	No	Data management

2. Background

The maxillary anterior region, owing to its particular esthetic importance and anatomical characteristics, is one of the most challenging areas in oral implantology. Immediate implant placement can effectively shorten the treatment period and preserve the alveolar ridge contour [1, 2]. The success of immediate implantation is no longer judged solely by osseointegration; rather, it depends on achieving long-term stable, harmonious, and natural soft tissue esthetics [1]. However, the inevitable physiological remodeling of the alveolar ridge after tooth extraction—particularly resorption of the labial bone plate and collapse of the soft tissues [3]—frequently results in an insufficient volume of peri-implant soft tissue, which in turn leads to esthetic complications such as loss of the interdental papillae, recession of the gingival margin, and unfavorable soft tissue contours, seriously compromising the "pink esthetics" score of the final restoration.

To address this challenge, soft tissue augmentation performed simultaneously with immediate implant placement has become one of the core techniques in modern implant dentistry in the esthetic zone. Autogenous connective tissue grafts (CTG) have long been regarded as the "gold standard" for soft tissue augmentation, offering good histocompatibility, stable volume maintenance, and the advantage of providing their own blood supply [4, 5]. Nevertheless, this technique has non-negligible limitations, including the need to create a second surgical site, increased postoperative pain and complications for the patient, and the risk of limited availability of donor tissue.

In recent years, with the rapid development of tissue engineering and biomaterials science, novel collagen matrices derived from porcine collagen have emerged and been introduced as potential alternatives to connective tissue grafts. These three-dimensional biomaterials are designed to mimic the biological functions of the extracellular matrix and to promote the migration, proliferation, and differentiation of host cells, thereby promoting regeneration of the patient's own soft tissue and avoiding the many drawbacks associated with harvesting autogenous tissue [6]. Although previous studies have demonstrated the potential of collagen matrices in conventional implant or periodontal surgery, high-level evidence from rigorously designed randomized controlled clinical trials is still lacking regarding their performance in the specific scenario of immediate implant placement in the maxillary anterior region—where esthetic demands are extremely high and soft tissue changes are dynamically complex—and in particular regarding direct, systematic comparisons with the gold-standard technique in terms of soft tissue contour stability, esthetic outcomes, and patient experience.

Therefore, this study aims to scientifically and objectively compare the clinical outcomes of a novel collagen matrix versus autogenous connective tissue graft for soft tissue augmentation in conjunction with immediate implant placement in the maxillary anterior region, in order to provide reliable evidence for clinical decision-making and to promote the optimization and innovation of treatment strategies for implant rehabilitation in the esthetic zone.

3. Objectives

3.1 Primary objective

To compare the changes in buccal soft tissue contour achieved by the novel collagen matrix versus the autogenous connective tissue graft for soft tissue augmentation at immediate implant placement in the maxillary anterior teeth.

3.2 Secondary objectives

To compare the novel collagen matrix and the autogenous connective tissue graft for soft tissue augmentation at immediate implant placement in the maxillary anterior teeth with respect to patient-reported outcomes, duration of soft tissue grafting, wound healing parameters, and esthetic outcomes.

4. Methods

4.1 Overall study design

Single diseased tooth in the maxillary anterior region, to be extracted with immediate implant placement.

Single-center, block-randomized, open-label, parallel-group controlled trial with a test for between-group differences.

4.2 Sample size

According to previous reports in the literature, the standard deviation in the test group is 0.57 mm (Sanz-Martín et al.). Sample size was calculated using PASS 2015 software for a test of the difference between two independent means, with a 1:1 allocation ratio between the test and control groups, $\alpha = 0.05$, and an expected between-group difference in means of 0.5 mm (Nimwegen et al.). According to the calculation, approximately 21 participants are required per group; allowing for a 10% dropout rate, 23 patients per group are required, for a total of 46 patients.

4.3 Randomization

The trial uses block randomization with a block length of 4–6. The randomization codes will be generated by computer simulation using SAS software (version 9.4 or later) by a professional statistician, and allocation concealment will be implemented using opaque sealed envelopes. The block length, random seed, and SAS program set during randomization will be documented in the randomization records to ensure that the randomization codes are reproducible. Once a participant is confirmed eligible, a randomization number will be assigned; the study staff will open the envelopes sequentially in order, documenting in detail who opened each envelope and when, and participants will be allocated to the two groups according to the randomization result.

4.4 Control and blinding

4.4.1 Choice of control

Control group: autogenous connective tissue graft.

4.4.2 Implementation of blinding

Because autogenous connective tissue grafting requires harvesting soft tissue from the patient's palate, blinding of participants is not feasible.

In addition, the operating surgeon cannot be blinded.

During the stage of data measurement and analysis, the personnel performing the measurements will be blinded.

4.5 Visit schedule

- Preoperative (Tpre)
- Intraoperative (T0)
- Immediately postoperative (T1)
- 3 days postoperative (T2)
- 7 days postoperative (T3)
- 2 weeks postoperative (T4)
- 3 months postoperative (T5)
- Delivery of the definitive prosthesis (T6)

5. Selection, Withdrawal, and Management of Participants

5.1 Diagnostic criteria

- Aged 18–80 years (inclusive).
- A diseased tooth in the maxillary anterior region that cannot be retained due to dental disease (e.g., caries, tooth structure loss) and requires extraction, while meeting the indications for immediate implant placement (no obvious infection; primary stability of the implant can be achieved).

5.2 Inclusion criteria

1. Intact labial bone wall (< 1 mm thick) or thin gingival biotype at the immediate implant site;
2. Absence of labial contour concavity;
3. Healthy adjacent teeth and opposing teeth;
4. Sufficient mesiodistal space and sufficient occlusal clearance;
5. Intact labial bone wall after minimally traumatic tooth extraction;

6. Voluntary participation in the study with signed informed consent.

5.3 Exclusion criteria

1. Patients with uncontrolled severe periodontitis;
2. Heavy smokers (> 10 cigarettes/day);
3. Other patients judged by the investigator to be unsuitable for immediate implant placement.

5.4 Removal and withdrawal criteria

5.4.1 Removal criteria

Participants already enrolled in this trial who meet any of the following conditions will be removed as removal cases:

(1) Violation of important entry criteria;

(2) The participant did not receive treatment with the investigational material;

(3) No post-randomization observation data at all.

5.4.2 Withdrawal criteria

Withdrawal refers to a situation in which an enrolled participant develops a condition during the trial that makes continued participation inadvisable, and the investigator decides that the case should be withdrawn from the trial. In accordance with the informed consent form, participants have the right to withdraw from the trial at any time. A participant who does not explicitly withdraw but no longer attends surgery or examinations and is lost to follow-up is also considered a withdrawal (or "dropout"). The reasons for withdrawal should be ascertained and documented whenever possible, for example: perceived lack of efficacy; intolerance to certain adverse reactions; inability to continue for personal reasons; financial reasons; or loss to follow-up without explanation.

(1) The participant's condition worsens or deteriorates during the trial, and emergency measures must be taken;

(2) During the trial, the participant develops concomitant diseases, complications, or special physiological changes that make continued participation inadvisable;

(3) Withdrawal decided by the participant.

5.4.3 Handling of data from withdrawn participants

Regardless of the reason, complete clinical records should be retained for participants who

withdraw from the trial. For all withdrawn participants, the case report form should record the conclusion of the trial participation and the reason for withdrawal. In general there are six categories: occurrence of adverse events (including adverse drug reactions and allergic reactions), lack of efficacy (deterioration or complications), protocol violation (including poor compliance), loss to follow-up (including participant-initiated withdrawal), termination by the sponsor, or others.

5.5 Conditions for termination of the trial

(1) Termination of the trial means that the clinical trial is stopped entirely before it is completed as planned in the protocol;

(2) If a serious safety problem occurs during the trial, the trial should be terminated promptly;

(3) If a major flaw is discovered in the design of the protocol, or a major deviation occurs in its implementation, such that the effect of the intervention cannot be evaluated, the trial should be terminated;

(4) Other circumstances requiring termination.

5.6 Participant management

5.6.1 Recruitment

Participants will be screened from consecutive patients attending the Department of Oral Implantology, Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine. A member of the study team will provide study-related information to potentially eligible patients and seek informed consent from those who are interested.

5.6.2 Informed consent process

Before any study procedure is performed, the participant must personally sign and date the latest approved version of the informed consent form. Study personnel will provide the written consent form to the patient and explain it verbally. After the inclusion and exclusion criteria have been confirmed, the participant will be enrolled in this study and will sign the informed consent form; only thereafter may study-related procedures and operations be performed.

Study personnel will explain the study-related information to the participant in detail, including at minimum: the exact nature of the study; the implications and restrictions of the protocol; and the known side effects and risks of participation. Study personnel must clearly inform the participant that he or she is free to withdraw from the study at any time and for any reason, without any obligation to state the reason, and that the participant's right to medical care and its quality will not be affected.

6. Trial Procedures

6.1 Description of the investigational product/device

Material: Geistlich Fibro-Gide is a porcine-derived, porous, resorbable, and volume-stable collagen matrix used as a tissue substitute for soft tissue regeneration. It has already been approved and marketed in China.

6.2 Methods of application

Test group: A tunnel flap combined with a vestibular incision subperiosteal tunnel access (VISTA) approach is used. A VISTA incision is made mesial to the maxillary anterior implant site; a full-thickness tunnel flap is elevated at the coronal aspect and a split-thickness flap at the apical aspect, and the flap is thoroughly released. The Fibro-Gide matrix is placed inside the flap without tension and secured to the labial tissue flap with 6-0 resorbable sutures.

Control group: A full-thickness tunnel flap is elevated and thoroughly released. A free gingival graft is harvested from the patient's palate, de-epithelialized, and placed into the buccal tunnel pouch, where it is secured to the labial tissue flap with 6-0 resorbable sutures.

6.3 Treatment course and visit schedule

(1) Signing of the informed consent form, preoperative periodontal treatment and other preparation;

(2) Preoperative examination (Tpre): CBCT, intraoral scanning, preoperative photography, preoperative blood flow measurement, gingival recession of adjacent teeth;

(3) Intraoperative (T0): intraoperative photography, gingival phenotype, examination of the bone wall morphology, graft measurement, duration of soft tissue surgery, etc.;

(4) Immediately postoperative (T1): patient-reported outcomes, blood flow, intraoral scanning;

(5) 3 days postoperative (T2): photography, blood flow, patient-reported outcomes;

(6) 7 days postoperative (T3): photography, blood flow, patient-reported outcomes;

(7) 14 days postoperative (T4): photography, blood flow, intraoral scanning;

(8) 3-month review (T5): CBCT examination, intraoral scanning, photography, blood flow;

(9) Delivery of the definitive prosthesis (T6): radiographs, intraoral scanning, photography, PES/WES, patient satisfaction, peri-implant probing (PD/BOP/PI/KMW), gingival margin position.

7. Outcome Measures

7.1 Baseline variables

Demographic data: name, sex, age, etc.;

Clinical examination: condition of adjacent teeth, oral hygiene status, periodontal status, gingival phenotype;

Imaging examination: CBCT assessment of the bone wall, intraoral scanning.

7.2 Efficacy evaluation

7.2.1 Primary outcome measure

Change in the buccal soft tissue contour at the implant site: based on intraoral scan data, the T5 scan will be matched to the Tpre scan. A region of interest (ROI) will be selected on the labial side, and the contour change between T5 and Tpre (Δvolume) will be calculated, from which the change in thickness Δd [mm] = Δvolume [mm^3] / area [mm^2] is derived (Nimwegen et al.). Definition of the region of interest (ROI): the boundaries of the region are jointly defined by the mesial and distal papilla margins of the adjacent tooth crowns, the mucogingival junction apically, and the crown margin coronally, as anatomical reference structures. Two investigators will perform the measurements independently, and inter-examiner agreement will be calculated.

7.2.2 Secondary outcome measures

1. Operative time: the time from preparation of the recipient flap (T0), harvesting of the soft tissue graft, to completion of suturing will be recorded.
2. Patient-reported outcomes: the participant's intraoperative experience will be recorded at T1; postoperative pain and OHIP-14 scores will be recorded at T2 and T3; and satisfaction with the restorative outcome will be recorded at T6. A visual analogue scale (VAS) will be used.
3. Wound healing parameters: blood flow measurements at Tpre, T1, T2, T3, T4, and T5. Blood flow will be measured with a PeriCam blood flow (laser speckle contrast) imager; the mean blood flow in the grafted labial soft tissue area will be measured using the PeriCam software.
4. Esthetic evaluation: the pink esthetic score / white esthetic score (PES/WES) will be assessed by two dentists on the basis of standardized photographs; in case of disagreement, the two assessors will discuss until consensus is reached.
5. Other measures: change in the buccal bone contour of the implant measured on CBCT, and changes in soft tissue contour based on superimposition of intraoral scans at different time points.

7.3 Safety evaluation

Adverse events.

(1) Relevant definitions: incidence of complications (at each visit): surgical complications such as wound infection.

(2) Recording of adverse events: adverse event record forms will be completed truthfully during the trial, documenting the time of occurrence, severity, duration, effective measures taken, and outcome of each adverse event.

8. Data Quality Assurance

8.1 Quality control and assurance

All investigators participating in this study will receive standardized training on study procedures, including questionnaires, collection and storage of blood samples, preoperative examinations and treatment, and administration of the interventions.

8.2 Data management

Primary data will be stored and retrieved at Shanghai Ninth People's Hospital. After data have been retrieved from the primary database for analysis, participants will be identified in the auxiliary database only by study-specific participant numbers and/or codes. Case report forms (CRFs) will be kept in paper format, with identifiers removed and identification codes assigned. The codes will be stored securely and separately from the data. Names and any other identifying details will not be included in any electronic auxiliary research data files. All files will be stored securely, with access restricted to trial personnel and authorized staff only. The investigators will archive the original documents, informed consent forms, and patient questionnaires for each participant. In addition, the investigators will maintain an enrollment list of included participants for matching with case report forms, clinical data records, CBCT images, radiographs, intraoral scan images, and clinical samples.

9. Statistical Analysis

9.1 Analysis sets

ITT set (intention-to-treat set); PP set (per-protocol set).

9.2 Statistical methods

Statistical analysis will be performed using SAS 9.4. All statistical tests in this study will be one-sided tests, and a P value less than 0.05 will be considered statistically significant. Continuous data will be described as mean ± standard deviation and compared using parametric tests (independent-samples t test). If continuous data are not normally distributed, they will be described with medians and compared using non-parametric methods (Wilcoxon rank-sum test).

10. Ethical Requirements and Informed Consent

10.1 Review by the Ethics Committee

This protocol, the written informed consent form, and all materials directly relevant to participants must be submitted to the Ethics Committee; the study may formally begin only after written approval has been obtained from the Ethics Committee. The investigator must submit an annual report to the Ethics Committee at least once a year (where applicable). Upon suspension and/or completion of the study, the investigator must notify the Ethics Committee in writing. The investigator must report promptly to the Ethics Committee all changes made during the study (e.g., amendments to the protocol and/or the informed consent form), and such changes may not be implemented before approval by the Ethics Committee has been obtained, unless made to eliminate an obvious and immediate risk to the participants. In such cases, the Ethics Committee will be notified.

10.2 Informed consent

The investigator must provide the participant or his/her legal representative with an easy-to-understand informed consent form approved by the Ethics Committee, and allow the participant or his/her legal representative sufficient time to consider participation in this study. No participant may be enrolled before a signed and dated written informed consent has been obtained. During participation, the participant will be provided with all updated versions of the informed consent form and written information. The informed consent form shall be retained as an essential document of the clinical trial for inspection.

11. Insurance

None.

12. References

[1] Shu-Jiao Qian, Yi-ping Pu, Xiao-Meng Zhang, Xin-Yu Wu, Bei-lei Liu, Hong-Chang Lai, Jun-Yu Shi. Clinical, radiographic, and esthetic evaluation of immediate implant placement with buccal bone dehiscence in the anterior maxilla: A 1-year prospective case series. Clin Implant Dent Relat Res. 2022;1–8.

[2] Xin-Yu Wu, Aneesha Acharya, Jun-Yu Shi, Shu-Jiao Qian, Hong-Chang Lai, Maurizio S. Tonetti. Surgical interventions for implant placement in the anterior maxilla: a systematic scoping review with evidence mapping. Clin Oral Impl Res. 2022;00:1–12.

[3] Shi-Min Wei, Yuan Li, Ke Deng, Hong-Chang Lai, Maurizio S. Tonetti, Jun-Yu Shi. Does machine-vision-assisted dynamic navigation improve the accuracy of digitally planned prosthetically guided immediate implant placement? A randomized controlled trial. Clin Oral Impl Res. 2022;33:804–815.

[4] van Nimwegen WG, Raghoebar GM, Zuiderveld EG, Jung RE, Meijer HJA, Mühlemann S. Immediate placement and provisionalization of implants in the aesthetic zone with or without a connective tissue graft: A 1-year randomized controlled trial and volumetric study. Clin Oral Implants Res. 2018 Jul;29(7):671-678.

[5] Wu XY, Shi JY, Buti J, Lai HC, Tonetti MS. Buccal bone thickness and mid-facial soft tissue recession after various surgical approaches for immediate implant placement: A systematic review and network meta-analysis of controlled trials. J Clin Periodontol. 2023 Apr;50(4):533-546.

[6] Sanz-Martín I, Encalada C, Sanz-Sánchez I, Aracil J, Sanz M. Soft tissue augmentation at immediate implants using a novel xenogeneic collagen matrix in conjunction with immediate provisional restorations: A prospective case series. Clin Implant Dent Relat Res. 2019 Feb;21(1):145-153.

Appendix 1: Clinical Trial Flow Chart

Patient screening → Application of inclusion/exclusion criteria → Informed consent → Patient enrollment → Randomization (block randomization, 1:1 allocation)

Test group: Fibro-Gide (N = 23)	**Control group: CTG (N = 23)**
Visit	**Assessments**
Preoperative (Tpre)	CBCT, intraoral scanning, blood flow measurement
Intraoperative (T0)	Graft measurement, duration of soft tissue surgery

Test group: Fibro-Gide (N = 23)	**Control group: CTG (N = 23)**
Visit	**Assessments**
Immediately postoperative (T1)	Patient-reported outcomes, blood flow, intraoral scanning
3 and 7 days postoperative (T2, T3)	Blood flow, patient-reported outcomes
14 days postoperative (T4)	Blood flow, intraoral scanning
3 months postoperative (T5)	CBCT examination, intraoral scanning, blood flow
Prosthesis delivery (T6)	Radiographs, intraoral scanning, PES/WES, patient satisfaction, peri-implant probing (PD/BOP/PI/KMW), gingival margin position

Note: In the Chinese original, Appendix 1 is presented as a flow chart image; the content above is a faithful text rendering of that flow chart.

Informed Consent Form

Study title: Comparison of a Novel Collagen Matrix and Connective Tissue Graft for Soft Tissue Augmentation in Conjunction with Immediate Implant Placement in the Maxillary Anterior Region: A Randomized Controlled Clinical Trial

Introduction

We sincerely invite you to take part in this study, entitled "Comparison of a Novel Collagen Matrix and Connective Tissue Graft for Soft Tissue Augmentation in Conjunction with Immediate Implant Placement in the Maxillary Anterior Region: A Randomized Controlled Clinical Trial". This study is led by Professor Lai Hongchang and has been reviewed and approved by the Ethics Committee of Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine.

Please read this informed consent form carefully and think carefully before deciding whether to take part in this study. Participation is entirely your own choice. As a study participant, you must give your written consent before joining the clinical study. When your research physician or study staff discuss the informed consent form with you, you may ask them to explain anything you do not understand. We encourage you to discuss fully with your family and friends before making your decision. You have the right to refuse to take part in this study, and you may withdraw at any time without any penalty and without losing any of the rights to which you are entitled. If you are currently taking part in another study, please inform your research physician or study staff.

Background

Soft tissue augmentation performed at the same time as immediate implant placement has become one of the core techniques in modern implant dentistry in the esthetic zone. Traditionally, autogenous connective tissue grafts have been used for soft tissue augmentation at immediate implants. However, this technique has non-negligible limitations, including the need to create a second surgical site, increased postoperative pain and complications, and the risk of limited availability of donor tissue. A novel, volume-stable collagen matrix material has already been approved and marketed in China and is being used as an alternative to connective tissue grafting. This novel collagen matrix can thicken the peri-implant soft tissue and avoids the pain and discomfort associated with harvesting autogenous tissue; however, rigorously designed randomized controlled clinical trials directly comparing this novel collagen matrix with connective tissue grafting are still lacking.

Objectives

The main objective of this study is to compare the novel collagen matrix with the autogenous connective tissue graft for soft tissue augmentation in conjunction with immediate implant

placement in the maxillary anterior region, with respect to buccal contour thickening, patient-reported comfort, and the final esthetic outcome.

Study Procedures

If you agree to take part and meet the entry criteria, you will be included in the study. This clinical study will enroll 46 participants in total.

The inclusion and exclusion criteria are as follows:

Patients aged 18–80 years (inclusive), with a diseased tooth in the maxillary anterior region that cannot be retained due to dental disease and requires extraction, and who at the same time meet the indications for immediate implant placement (no obvious infection; primary stability of the implant can be achieved), will be screened and invited to take part in the trial.

Inclusion criteria:

1. Intact labial bone wall (< 1 mm) or thin gingival biotype at the immediate implant site;
2. Absence of labial contour concavity;
3. Healthy adjacent teeth and opposing teeth;
4. Sufficient mesiodistal space and sufficient occlusal clearance;
5. Intact labial bone wall after minimally traumatic tooth extraction;
6. Voluntary participation in the study with signed informed consent.

Exclusion criteria:

1. Patients with uncontrolled severe periodontitis;
2. Heavy smokers (> 10 cigarettes/day);
3. Other patients judged by the investigator to be unsuitable for immediate implant placement.

The study comprises three stages: a screening stage, a treatment stage, and a follow-up stage.

- Screening stage: If you are willing to take part, then after you have given your written signed consent, the doctor will collect your clinical information (which may include the results of previous medical examinations) and complete the relevant examinations, in order to determine whether you are suitable to enter this study.
- Treatment stage: If you meet the inclusion criteria of this clinical study, experienced clinicians will provide you with standard restorative treatment. You will be randomized with a 1:1 probability to either the autogenous connective tissue graft group or the novel collagen matrix group. The entire study involves about 7–8 visits over approximately 4 months, each of which may last 20–60 minutes. All visits are part of the routine schedule of implant treatment, so no additional appointments are required for the study.

- Follow-up stage: The doctors' follow-up observation will continue until the delivery of your definitive prosthesis, and may be extended if necessary. During this period, you may also need to undergo some safety-related medical observations or examinations.

This study is expected to last 2 years in total; for you personally, participation in the study will last about half a year.

Potential Benefits and Risks

To compensate for the possible inconvenience of taking part in this study, the fees for the postoperative oral imaging examinations performed during your participation will be waived, as well as the cost of the novel collagen matrix material. Impression-taking and other surgical and restorative fees are not covered by the waiver. Treatment and examinations required for any other coexisting conditions you may have are not covered by the waiver. This study does not provide transportation reimbursement.

The combined evidence from numerous clinical trials shows that the collagen matrix is a safe and effective method for soft tissue thickening. Occasionally, patients may experience postoperative complications such as pain, swelling, or even infection; these can be treated further with anti-infective therapy. If any discomfort or adverse reaction occurs, please contact the research physician promptly, and the research physician will provide active diagnosis and treatment.

Study Costs and Compensation

The cost of the novel collagen matrix material will be waived. Routine treatment and examinations required for other coexisting diseases are not covered by the waiver. This study does not provide a transportation allowance.

Alternative Treatment Options

If you choose not to take part in this study, or to withdraw from it, you retain the full right to receive other surgical or non-surgical treatment options on the professional advice of your attending physician.

Whether or not you ultimately take part in this study will not affect your physician's objective medical evaluation and decision-making regarding your condition and the relevant treatment options.

Your Rights and Obligations

Participation in this study is entirely voluntary. You may withdraw from the study at any time, unconditionally, and this will by no means affect your relationship with the medical staff or your future diagnosis and treatment. All your information will be kept strictly confidential. Only relevant personnel may access your medical records, in order to check the accuracy of the

collected information and to ensure the proper conduct of the study. Any electronically transmitted information will be re-coded to ensure confidentiality. All information stored on computers will be protected by passwords. When the results of this study are reported at medical conferences or published in scientific journals, no personally identifiable information about you will be disclosed. If you decide to take part, we will ask you to sign an informed consent form, and you will keep a copy.

During the study, you are obliged to provide the research physician with truthful information about your medical history and current state of health; to tell the research physician about any discomfort you experience during the study; not to take restricted medications, foods, etc.; to tell the research physician whether you have recently taken part in, or are currently taking part in, any other studies; and to complete the follow-up visits as required by the study and to cooperate carefully with the research physician throughout the study.

After reading this information and discussing it with your doctor, if you have any further questions or concerns, please contact:

Investigator: Dr. Fu Xiaojiao

Telephone: 021-53315299

Address: Department of Oral Implantology, Shanghai Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine

If you have any questions about your rights, please contact the Medical Ethics Committee directly: 021-63057795.

Signature Page of the Participant's Informed Consent Form

I have been fully informed of the nature, purpose, methods, duration, and possible risks and benefits of this clinical study. All the questions I asked the research physician have been satisfactorily answered. After careful consideration, I voluntarily agree to take part in this study and am willing to cooperate closely with the research physician to complete the entire treatment and observation process specified in the study protocol.

- I may ask the physician for more relevant information at any time;
- I may withdraw from this study at any time without discrimination or retaliation, and my medical treatment and rights will not be affected;
- I agree that the relevant regulatory authorities, the Ethics Committee, and representatives of the investigators may access my study records when necessary;
- I have received a copy of the informed consent form signed and dated jointly by myself and the research physician;
- I have decided to take part in this study and am willing to strictly follow the requirements of the study protocol and cooperate with the physician to complete the entire study.

Study participant (signature):

Legal representative (signature):

Telephone:

Relationship to the study participant:

Date: ***Year*** **Month** __ Day

Reason for signing on behalf of the participant:

Telephone:

Date: ***Year*** **Month** __ Day

Research physician (signature):

Telephone:

Date of signature:

I have accurately communicated the contents of this document to the study participant. He/she has read this informed consent form accurately, and I certify that the study participant had the opportunity to ask questions. I certify that his/her consent was given voluntarily.

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