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Comparison of treatment outcomes and time efficiency between a digital complete denture and conventional complete denture

A pilot study

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ABSTRACT

Background. The authors of this study aimed to compare the treatment outcomes and time efficiency between digital and conventional complete denture restorations and propose suggestions for clinical use.

Methods. The authors used digital (functionally suitable digital complete denture [FSD]) and conventional complete denture restorations to make 2 dentures each for 10 edentulous patients. All the operations of both techniques before denture delivery were completed in the first 4 visits, and then 2 dentures were delivered successively for the patients. The clinical and laboratory times were recorded to evaluate the time efficiency; treatment outcomes were evaluated via scoring the denture satisfaction of the dentist and patients in a double-blind manner.

Results. The satisfaction scores of FSDs (7.6-9.6 [dentist's scores], 8.4-10 [patients' scores]) were higher than those of conventional dentures (7.2-9.7 [dentist's score], 7.4-9.8 [patients' scores]), but there were no significant differences. The clinical and laboratory operation times of the FSD group were less than those of the conventional group, saving an average of 28.0 minutes and 64.3 minutes in the clinic and laboratory, respectively.

Conclusions. FSD technology can improve the efficiency of clinical and laboratory operations and shorten the manufacturing cycle of dentures. The occlusion stability of FSDs was statistically better than that of traditional dentures, but there was no statistical difference in other clinical indicators.

Practical Implications. FSD technology is low cost and easy to operate and has several applications. Compared with conventional complete denture restoration technology, FSDs can save time and have a comparable clinical effect. This clinical trial was registered at the Chinese Clinical Trial Registry. The registration number is ChiCTR1900021722.

Key Words. CAD; complete denture; removable prosthodontics; treatment outcome; 3-dimensional printing.

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Digital complete dentures have many advantages compared with conventional complete dentures: reduced number of patient visits, improved denture fabrication efficiency and accuracy, and no polymerization shrinkage or monomer residue.[1-3] Several digital complete denture restoration systems have appeared worldwide, such as AvaDent (Global Dental Science), Dentca (Dentca), Wieland digital denture (Ivoclar Vivadent), Baltic (Merz Dental), and Ceramill Full Denture System (Amann Girrbach).[2] These systems can condense the number of visits to 2 to 4 times from the first visit to denture delivery. Several studies have shown that dentures fabricated with computer-aided design and computer-aided manufacturing can improve patient satisfaction, reaching 80%.[4,5]

Some studies have reported that digital complete denture restoration can reduce the treatment time and total cost compared with conventional complete dentures.[6-9] Srinivasan and colleagues[7] reported that an average of 233 minutes (maxillary and mandibular) and 108 minutes (maxillary) in clinical time could be saved via digital complete denture restoration. Treatment cost is another

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critical parameter that should be evaluated owing to its relationship with the acceptability of dentists and patients. Srinivasan and colleagues[7] recorded that the laboratory fee for AvaDent digital dentures was lower than that of conventional dentures and the cost of in-house digital production was lower than the fee sent to the commercial laboratory in Switzerland.[6] However, this conclusion does not apply to all regions; in some areas, the cost of conventional dentures was much lower than those of CAD-CAM–fabricated dentures.[2] For those areas, dentists and patients may prefer conventional dentures owing to the lower cost when CAD-CAM–fabricated dentures show imperceptible clinical effect improvement. In addition, in terms of clinical practice, the 1-step impression technique in the AvaDent, Dentca, and Baltic systems may not apply to all patients, such as patients with severe absorption of the alveolar ridge. In addition, some systems need additional matching tools, such as the ^{BD}KEY Set (Baltic Denture System), the anatomic measuring device in the AvaDent system, and the 2-piece trays in the Dentca system, limiting the clinical attempts in some dentists. Yilmaz and colleagues[10] believe that digital complete denture technology still has many shortcomings; therefore, combining conventional technology can maximize the advantages.

On the basis of the principle of reduction in the number of clinical visits, simplification of clinical operations, and no additional costs incurred during denture fabrication, our research group developed a digital complete denture restoration (functionally suitable digital complete denture [FSD]).[11,12] On the basis of the primary impression, jaw relation, and esthetic information obtained at the first visit, we designed and printed a closed-mouth tray with the shape of a complete denture to make the final impression, jaw relation, and esthetic confirmation; thus, the denture could be delivered at the third visit. No additional tools were needed, and a 2-step impression technique was used to suit more patients. The final denture was fabricated using a combined digital-conventional method without increasing the cost, and metal mesh can be added to the base to increase its strength. In this study, we aimed to compare the treatment outcomes and time efficiency between FSD and conventional complete denture restorations and propose suggestions for clinical use. The treatment outcomes of FSDs were evaluated via self-controlled study. The null hypothesis is that there is no difference between FSD technology and conventional technology regarding dentist's and patients' scores and time consumption.

METHODS

The inclusion criteria were maxillary and mandibular edentulous jaws for more than 3 months, acceptance of removable complete denture restoration, and good cooperative attitude. The exclusion criteria were obvious defect in the maxillary and mandibular jaws, serious oral mucosal diseases without effective treatment, obvious flabby alveolar ridge, the presence of mental illness or Parkinson disease and inability to care for themselves, and sensitive pharynx reflex. A total of 10 edentulous patients (3 males, 7 females) were enrolled in this study, with an average (SD) age of 70.9 (11.5) years. According to the Atwood classification of the alveolar ridge, there were 2 patients in Class I, 6 patients in Class II, and 2 patients in Class III; 5 patients had old dentures, and another 5 patients experienced complete denture restoration for the first time. Conventional complete dentures and FSDs were made for each patient (Figure 1). All patients signed informed consent forms. In return, patients participating in the study were exempted from the cost of treatment and denture fabrication fees.

Conventional restoration

Using the conventional 5-visit workflow, we obtained the primary impression with impression paste (Red, Shanghai Rongxiang Dental Material) at the first visit (Figures 2A and 2D). Then, we scanned the impressions with a laboratory scanner (Dentscan Y500, Nanjing Geosmart3D Information Technology) and exported the scans to standard template library files. We designed custom trays (Hoteamsoft) in which the margin retreats 2 mm for the space of border molding, with 1 mm offset in the intaglio surface for the space of impression material and semicircular tissue stops on the intaglio surface (Figures 3A and 3B). We printed the custom trays using a 3-dimensional (3D) printer (Lingtong I, BeijingSHINO) with polylactic acid as the material and set the printing layer thickness to 0.2 mm.

During the patient's second visit, we used low-fluidity silicone rubber (Type 1, Shandong Huge Dental Material) for border molding and high-fluidity silicone rubber (Type 3, Shandong Huge Dental Material) to obtain the final impression (Figures 3C and 3D). The plaster models were poured by the final impression; then, we manually made the occlusion rims with light-curing resin (Shandong Huge Dental Material) and wax on the plaster. When the patient visited for the third

ABBREVIATION KEY

CAD-CAM: Computer-aided design and computer-aided manufacturing.
FSD: Functionally suitable digital complete denture.
3D: 3-dimensional.

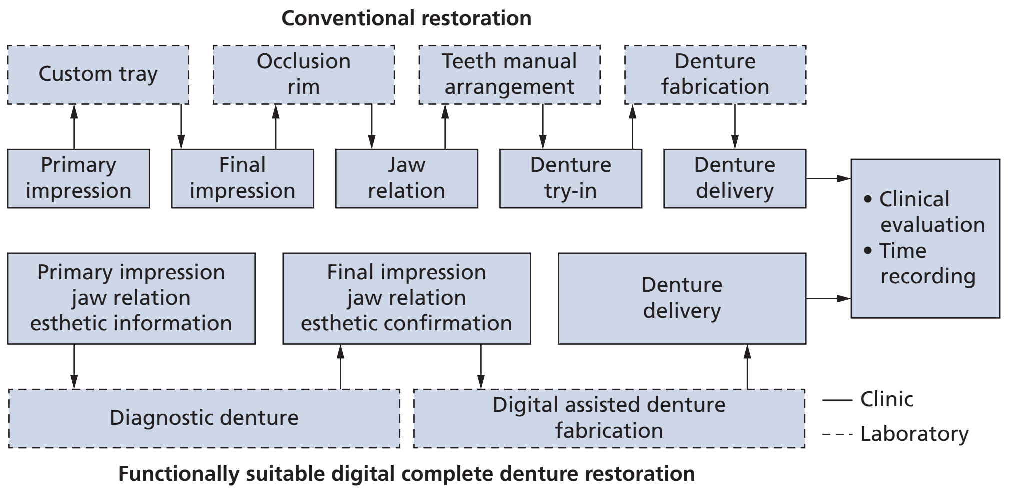

Figure 1. Flowchart of conventional and functionally suitable digital complete denture restoration.

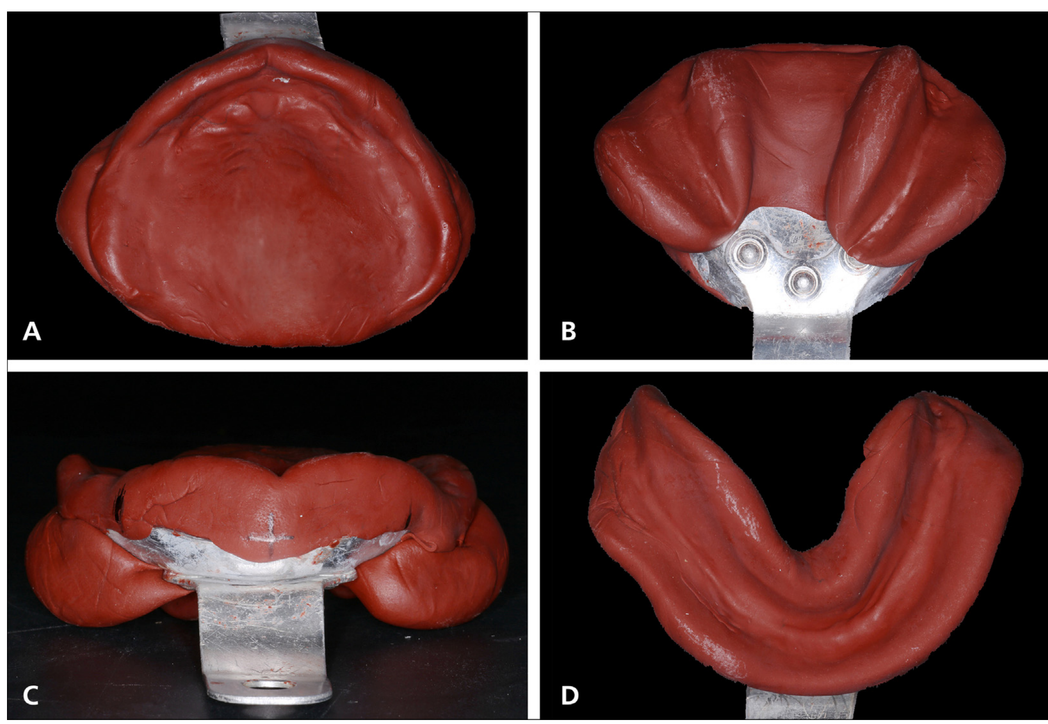

Figure 2. Primary impression, primary jaw relation, and esthetic information. **A.** Maxillary jaw impression. **B.** Primary jaw relation. **C.** Esthetic information. **D.** Mandibular jaw impression.

time, we used occlusion rims to confirm the occlusion plane, record the jaw relationship, and mark esthetic information. We transferred the plaster model and occlusion rim to the laboratory for mounting to the articulator. We manually made the conventional try-in denture using stock teeth and wax. At the fourth visit, the wax try-in denture was inserted to check the vertical dimension and horizontal relationship, and the dentist and patient jointly confirmed the esthetic information (Figure 3E). We transferred the plaster model and try-in denture to the laboratory to fabricate the final denture (Figure 3F).

FSD restoration

Unlike conventional technology, additional primary jaw relations and esthetic information needed to be obtained in FSD during the first visit. We measured the distance between the patient's nasal

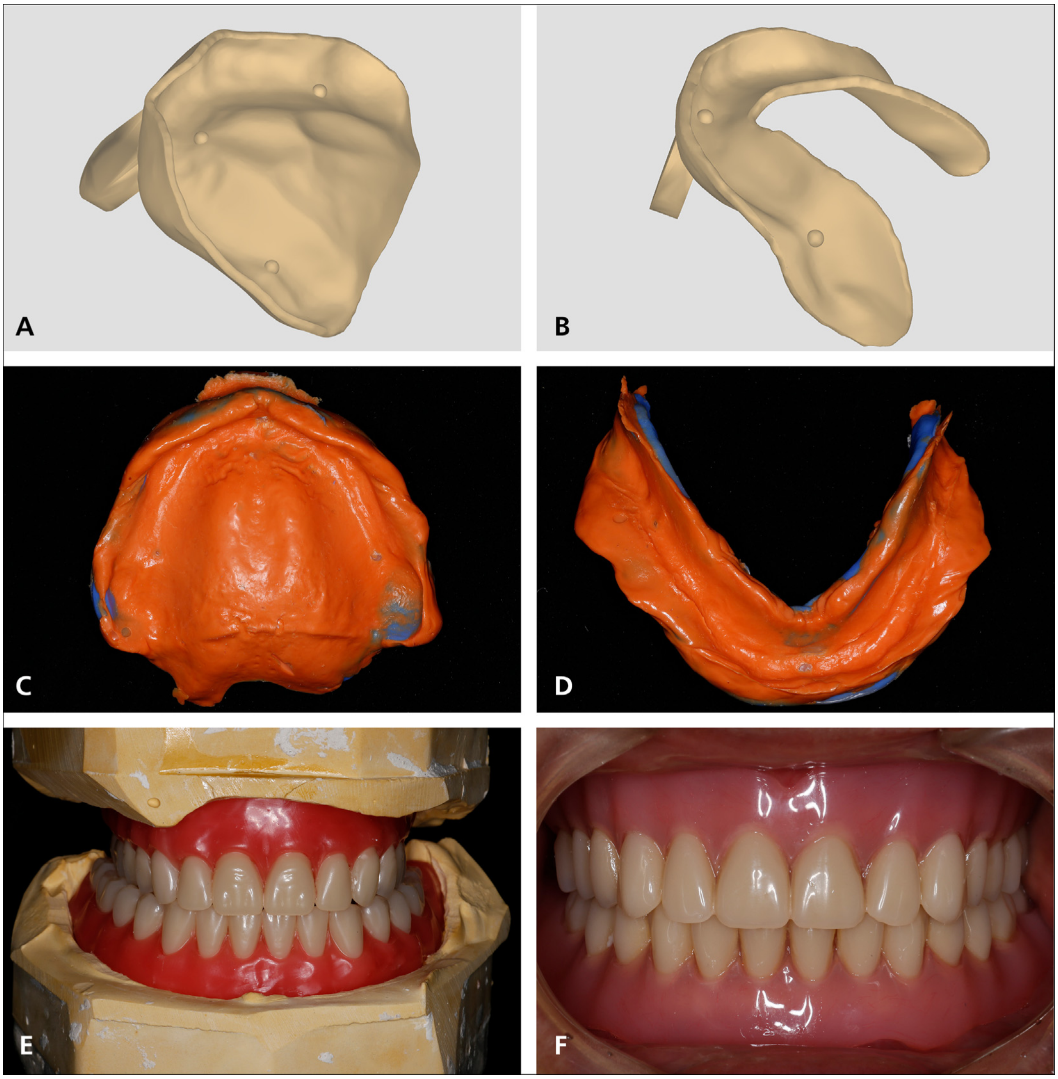

Figure 3. Conventional complete denture restoration. **A.** Maxillary tray. **B.** Mandibular tray. **C.** Maxillary final impression. **D.** Mandibular final impression. **E.** Try-in denture. **F.** Final denture.

tip and the front of the chin as the rest vertical position dimension and subtracted 2 mm from it as the patient's occlusion vertical dimension. We put impression paste on the back of the maxillary impression (already obtained in the conventional restoration; in this study, FSD and conventional restorations shared the primary impression) and asked the patient to bite to a vertical dimension (Figure 2B). We adjusted the lip support and marked the midline, the mouth corner line, and the smile line (Figure 2C).

We scanned the primary jaw relation record and imported the data of the impression and jaw relation record into the complete denture design software (Hoteamsoft). Alignment was made between the jaw relation record and mandibular impression to reconstruct the relationship between the maxillary and mandibular jaws. We designed a closed-mouth custom tray with the shape of a complete denture (named diagnostic denture), in which the intaglio surface design was the same as a custom tray that was margin retracted, intaglio surface 1 mm offset and tissue stops set (Figures 4A-C). We printed the diagnostic denture using a 3D printer (Lingtong I) and set the printing layer thickness to 0.2 mm.

We inserted the diagnostic denture into the mouth to check for occlusion and esthetics at the next visit. The occlusion could be adjusted via grinding the teeth, and esthetic dissatisfaction could be adjusted via marking or grinding on it. Then, we used the diagnostic denture to obtain closed-mouth definitive impressions, in which we used low-fluidity silicone rubber for border molding and high-fluidity silicone rubber for the final impression. When border molding and obtaining

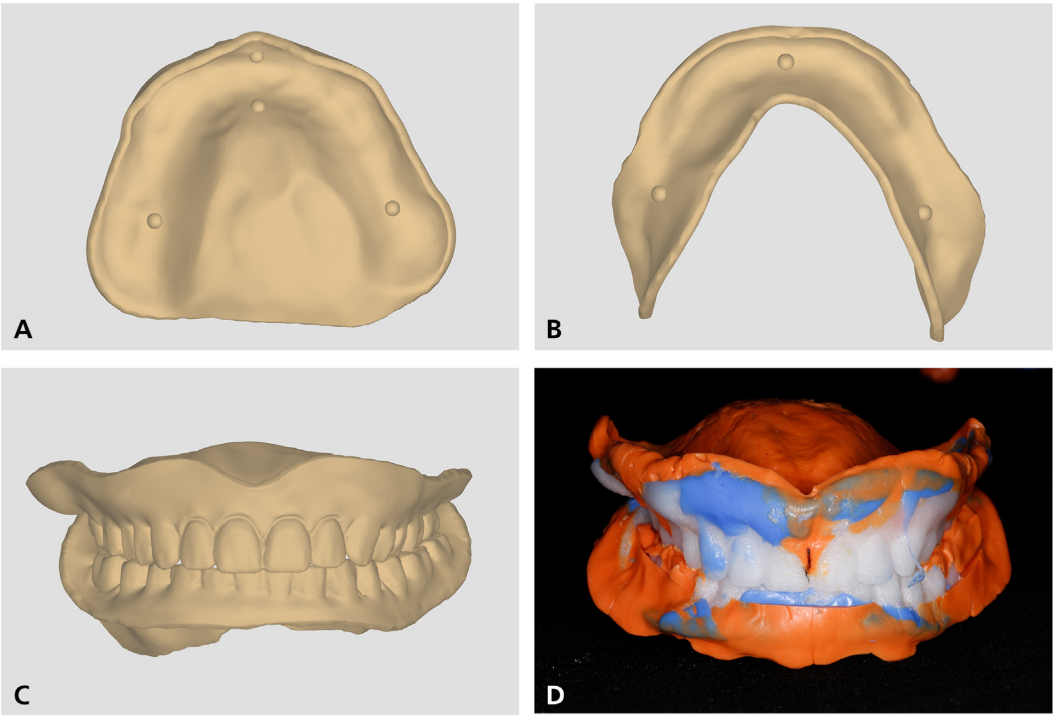

Figure 4. Functionally suitable digital complete denture restoration. **A.** Intaglio surface of the maxillary diagnostic denture. **B.** Intaglio surface of the mandibular diagnostic denture. **C.** Front view of the diagnostic denture. **D.** Functionally suitable digital complete denture final impression and jaw relation.

impressions, the opposite arch diagnostic denture was in the mouth to ensure that the occlusion was not changed in the process of making impressions. After obtaining the impression, we checked the vertical dimension and the horizontal relationship again and adjusted any error or unstable occlusion by means of adding wax or grinding. We used the tooth position and masticatory muscle force when the patient repeatedly bit to judge whether the occlusion was stable. We recorded the jaw relation after occlusion adjustment using silicone rubber (Figure 4D). This visit could be completed at 1 of the second to fourth visits during conventional restoration.

We scanned the final impression and imported it into the complete denture design software to design the final complete denture, and we set a 0.1 mm offset in the intaglio surface as the in situ gap. We printed the denture with a digital light processing printer (BeijingSHINO) and set the printing layer to 0.1 mm. We poured the final impression into the plaster model and mounted it into an articulator. We placed the printed denture on the plaster model and used silicone rubber to wrap the dentition (Figures 5A-C). After flasking, we removed the printed denture and set commercial teeth on the tooth sockets formed by the printed denture (Figure 5D). We used conventional methods, such as filling the resin, deflasking, remounting to the articulator, grinding, and polishing, to fabricate the final complete denture (Figures 5E and 5F).

Denture delivery and evaluation

We delivered the conventional denture and FSD at the patient's fifth visit. The same dentist (nonoperation dentist) scored both dentures, including denture retention, stability, occlusal stability, and margin extension. We randomly divided the patients into 2 groups. For group A, the procedures were conventional complete dentures were first delivered and a patient's score was obtained after 1 week, during which the denture was adjusted once or twice. The adjustment included adjusting the occlusion, adjusting the intaglio surface of the denture to the area where the mucosa excessively pressed, and adjusting the excessively long base margin area. Then, a 1-week washout period was designed, during which the denture was retracted, and the patient was told to wear the old denture or nothing. Finally, the FSD denture was delivered after 1 week of washout, and a patient's score was obtained after 1 week, during which the denture was adjusted once, similar to the conventional denture. The procedures for group B were opposite those of group A; the

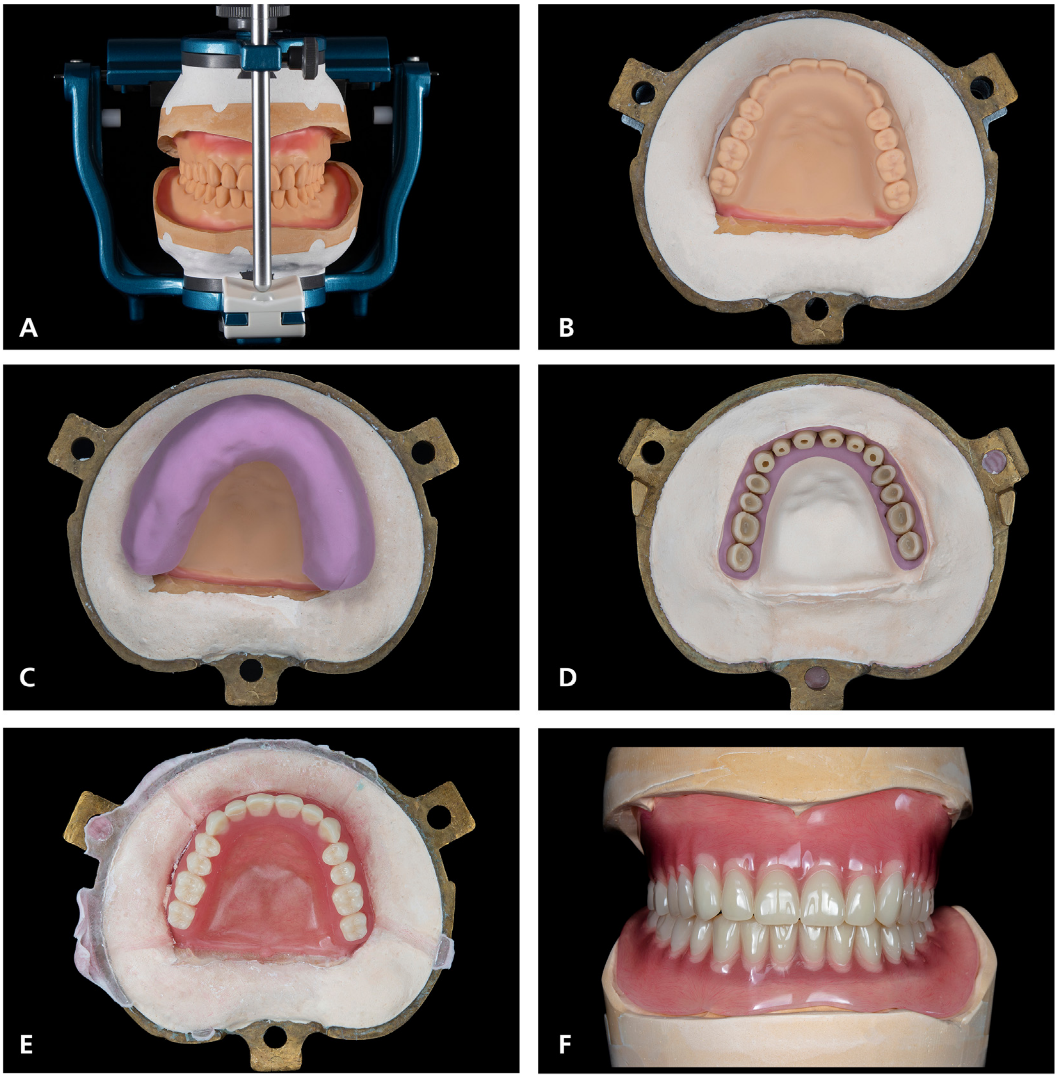

Figure 5. Fabrication of functionally suitable digital complete dentures. **A.** Place printed denture on the plaster model. **B.** Flasking. **C.** Silicone rubber wrapped on the dentition. **D.** Artificial teeth were set on the tooth socket. **E.** Deflasking after filling the base resin. **F.** Final denture.

conventional denture was delivered after the FSD. The dentist's evaluation was at the time when the denture was first delivered, and it included evaluation of denture retention, stability, occlusal stability, and margin extension. The patients' scores included denture retention, stability, mastication, comfort, and esthetics. All scoring indicators ranged from 0 through 10. A double-blind method was used; neither the patients nor the dentist who scored the denture knew the grouping of the experiment. After scoring, the 2 dentures were adjusted to satisfaction, and the patient could take both home and choose which one to wear.

All clinical operations were completed by 1 dentist (K.D.) who had used conventional and FSD techniques to complete more than 20 cases before the study to ensure the proficiency of the operation. All laboratory operations were completed by 1 technician, and all evaluations were completed by another dentist (Y.S.). The time of each clinical operation and laboratory operation step were recorded to compare the efficiency of the 2 protocols. Costs were initially assessed for both protocols, including material cost and labor cost. All labor costs were calculated via multiplying the hourly wages of the authors' staff by the time spent.

Statistical analysis

We imported the dentist's and patients' scores of the 2 dentures and time consumption into SPSS (IBM) software for statistical analysis. We performed the Shapiro-Wilk test before data analysis to

Table 1. Comparison of clinical and laboratory times of the 2 repair methods.

PROCEDURE	CONVENTIONAL TECHNIQUE, MIN (SD)	FUNCTIONALLY SUITABLE DIGITAL COMPLETE DENTURE TECHNIQUE, MIN (SD)
First Clinical Visit		
Primary impression	20.7 (8.7)	Not applicable
Primary impression, jaw relation, esthetic information	Not applicable	36.5 (13.1)
Laboratory Operation		
Custom tray	9.8 (1.5)	Not applicable
Data alignment, diagnostic denture computer-aided design, generating printing files	Not applicable	30.0 (5.8)
Second Clinical Visit		
Final impression	26.0 (6.6)	Not applicable
Final impression, jaw relation, esthetic confirmation	Not applicable	53.0 (17.0)
Laboratory Operation		
Occlusion rim	33.0 (4.8)	Not applicable
Third Clinical Visit		
Jaw relation	50.0 (12.5)	Not applicable
Laboratory Operation		
Teeth manual arrangement*	60.0	Not applicable
Wax pattern trimming*	60.0	Not applicable
3-dimensional scanning, complete denture computer-aided design, generating printing files	Not applicable	33.0 (6.7)
3-dimensional printing denture placement on the model and trimming*	Not applicable	60.0
Replacement of artificial teeth*	Not applicable	15.0
Fourth Clinical Visit		
Denture try-in	10.5 (10.9)	Not applicable
Fifth Clinical Visit and Postinsertion Denture Adjustment		
Denture delivery and adjustment	46.3 (13.8)	39.5 (18.5)
Total Clinical Time	158.5 (29.6)	130.5 (30.5)
Total Laboratory Time†	162.8 (6.0)	98.5 (9.4)

* Refers to the average time recalled by the technicians in this study according to experience. † This time is not the total laboratory time of all complete denture fabrication. The operations that are same in the 2 methods are not included in the calculation, including the scanning of the primary impression, pouring plaster model (in both groups, the plaster model was poured once), mounting to the articulator, flasking, filling resin, remounting to articulator adjustment, and denture grinding and polishing; the total time of these is approximately 2 hours.

judge whether the scores and time consumption conformed to normality. We used a paired t test if the data were distributed normally; otherwise, we used paired Wilcoxon rank-sum test ($\alpha = 0.05$).

RESULTS

In this study, 4 patients entered group A, and 6 patients entered group B. There was a statistical difference in the clinical operation time between the 2 protocols (the data of the 2 groups' Shapiro-Wilk test [$P > .05$], which were consistent with normality, and the paired t test was used [$P = .009 < .05$]). From the mean value, the FSD technology could save 28.0 minutes in clinical operation time. There was a statistical difference between the 2 operation protocols in the time consumption

Table 2. Denture satisfaction of dentist and patients in the 2 groups (full score of 10).

ITEM	CONVENTIONAL DENTURE, MEAN (SD)	FUNCTIONALLY SUITABLE DIGITAL COMPLETE DENTURE, MEAN (SD)	*P* VALUE
Dentist's Score			
Retention (maxillary)	9.1 (0.7)	8.9 (1)	.516
Retention (mandibular)	7.2 (0.9)	7.6 (1)	.343*
Stable (maxillary)	8.3 (1.1)	8.6 (1)	.279*
Stable (mandibular)	8.4 (1.1)	8.6 (0.8)	.509*
Margin extension (maxillary)	9.7 (0.9)	9.6 (1.0)	.317
Marginal extension (mandibular)	8.7 (1.2)	8.5 (1.3)	.434*
Occlusal stability	8 (1.4)	9 (1.1)	.031†
Patients' Scores			
Mastication	7.4 (1.2)	8.4 (1.3)	.070
Pronunciation	9.4 (1.3)	10 (0.0)	.102
Esthetic	9.8 (0.4)	9.6 (0.7)	.102
Denture stability	7.7 (1.3)	8.6 (1.0)	.176
Comfort	8.3 (1.2)	8.7 (1.0)	.242*

* Refers to the data that conform to normality using paired *t* test, and the rest using paired Wilcoxon rank-sum test. † $P < .05$, indicating a statistical difference.

in the laboratory (Shapiro-Wilk test of traditional protocol [$P < .05$], paired Wilcoxon rank-sum test [$P = .005 < .05$]). From the mean value, FSD technology can save 64.3 minutes in the laboratory (Table 1). The null hypothesis of time consumption was rejected. Furthermore, the mean (SD) number of FSD protocol return visits was 1.4 (0.5), and the mean (SD) number of conventional protocol return visits was 1.7 (0.5).

The dentist's and patients' scores are shown in Table 2. Only the occlusal stability showed a statistical difference; the FSDs showed better occlusal stability. Therefore, the null hypothesis of the dentist's score was rejected. On average, the retention and denture stability of the mandibular jaw in the FSD group were higher than those in the conventional denture group. The esthetics, maxillary jaw retention, and patients' scores of the maxillary denture were lower than those in the conventional group. However, there was no significant difference between the 2 groups ($P > .05$); therefore, the null hypothesis of the patients' score was accepted.

The cost analysis of the 2 protocols is shown in Table 3. FSD technology can save 67 Chinese yuan ($9.50) in the clinic and 70 yuan ($10) in the laboratory.

DISCUSSION

Digital technology undoubtedly has brought innovation to edentulous jaw restoration: fewer visits, less time consumption, and better clinical effects of restoration. In this study, we proposed and verified a digital complete denture restoration, including efficiency and denture effects. Regarding workflow, some complete denture systems, such as the Wieland 3-visit workflow,[2] are similar to the FSD workflow, in which the try-in denture is printed or milled to clinic try-in and the intaglio surface reline. However, the diagnostic denture in the FSD protocol focuses more on the impression-obtaining process: the retraction of margin, offset of intaglio surface, and setting of tissue stops, which aim to make a high-quality secondary impression. Centric Tray (Ivoclar-Vivadent) also is used commonly to obtain primary jaw relations.[13,14] The difference is that in FSD protocol, the impression material is placed on the posterior area, avoiding protrusion occlusion in Centric Tray in which the impression materials are placed only in front of the dental arch.

The mandibular denture retention and occlusal stability of the dentist's score and chewing and comfort in the patients' scores in the FSD group were higher than those in the conventional restoration group. This may be related to how the impression was obtained, that is, the closed-

Table 3. Cost evaluation of 2 complete denture protocols.

ITEM	CONVENTIONAL, ¥ ($*)	FUNCTIONALLY SUITABLE DIGITAL COMPLETE DENTURE, ¥ ($*)
Clinic		
Materials: impression materials	150 (21)	150 (21)
Labor cost of dentist	378 (53)	311 (43)
Total of clinic material and labor	528 (74)	461 (64)
Laboratory		
Materials: diagnostic denture	Not applicable	6 (1)
Materials: custom tray and occlusion rim	30 (4)	Not applicable
Materials: final denture	40 (6)	70 (10)
Labor cost of technician	336 (47)	260 (36)
Total of laboratory material and labor	406 (57)	336 (47)
Long-Term Investment		
Software	Not applicable	20,000 (2,790)
Scanner	Not applicable	40,000 (5,580)
3-dimensional printer	Not applicable	80,000 (11,160)
Total	Not applicable	140,000 (19,530)

* Rounded to the nearest integer.

mouth vs the open-mouth impression technique. When the open-mouth impression technique is used, the tray handle and operator's finger interfere with the patient's lips from contacting each other; therefore, the vestibular sulcus is in a more stretched condition, and passive border molding cannot be avoided owing to these interferences.[15] The closed-mouth impression obtained with the FSD technique records the true position of vestibular tissues under a functional state when the patient's lips contact each other, similar to the state when the patient chews with the final complete denture. In addition, there was good retention between the closed-mouth impression and the mucosa; therefore, the simultaneous recording of the jaw relation was more accurate and reliable than the conventional occlusion rim. However, the maxillary denture retention and esthetics score in the FSD group was slightly lower than in the conventional group. It may be that the FSD impression was obtained under the patient's occlusion, leading to the deformity of the maxillary mucosa. Therefore, the initial static retention was not as good as the impression obtained via the open-mouth tray. As for the lower score in esthetics, it may be due to the insufficiently realistic esthetic of diagnostic dentures compared with conventional try-in wax dentures. In our study, all enrolled patients were exempted from treatment expenses, which might have led to lower patient expectations and made the scores higher than in a real situation.

We recorded time to analyze the efficiency of the 2 techniques. In a previous study, the process of manual custom trays, including marking the margin line of the tray on the plaster, filling the undercut and relief area, and forming the tray (excluding the light-curing process), took an average (SD) of 31.1 (5.7) minutes.[16] In our study, we used digital custom trays in the conventional restoration, reducing the clinical and laboratory time. If the manual custom tray protocol had been adapted, more time would have been spent in the conventional restoration group. The most time-consuming step in the conventional technique was the jaw relation record, which took an average of 50 minutes. Correspondingly, the most time-consuming step in the FSD technique was the second visit; that is, the final impression obtaining, jaw relation record, and esthetic confirmation, which took an average of 53 minutes. However, FSD still took less time than the conventional technique, including final impression obtaining, jaw relation record, and denture try-in. In terms of denture fabrication, compared with the 2 hours needed in the manual tooth arrangement and wax base trimming, 33 minutes were required to scan impressions, design complete dentures, and generate printing files with FSD. FSD technology can save more time in the laboratory, and there is still space to improve the design efficiency of digital complete dentures if the complete denture design software is further optimized. In our study, both conventional and FSD operations were less time-consuming than in previous studies.[6] This may be because the operator in our study had much experience in complete denture restoration, whereas other studies might have chosen students with little experience.

We have made a preliminary evaluation of the cost of FSD. In the restoration of complete dentures, whether in the clinical or laboratory setting, the proportion of material cost is not large, and labor occupies the main cost. In related research, the direct digital processing of complete dentures can reduce greatly the time consumed by technicians. Although the cost of materials increases, the cost of digital complete dentures is still lower owing to the greater labor-cost savings.[6-9] However, these studies were conducted in Sweden, the United States, and Japan, where labor costs are high. In many countries, including China where we are located, the labor cost saved using milling to fabricate complete dentures is far lower than the material cost increase it brings, not to mention the use of expensive milling machines. This is also why promoting digital complete dentures is difficult in these areas. The FSD protocol considers integrating digital technology into restoring complete dentures when labor cost is not high. Instead of milling, the FSDs technique adopted an indirect way to fabricate complete dentures, allowing technicians with less experience in tooth arrangement to complete the fabrication of dentures in less time and without increasing the material cost. In addition, FSDs also can be used for patients with large occlusions in whom there is a need for added metal mesh in the denture, which is impossible for CAD-CAM fabrication. When the technology of 3D printing the final complete denture is improved further and the material has obtained administration certification in the local area, the denture can be processed directly using this technology. However, although FSD technology can save more costs in the clinical and laboratory settings, it requires a long-term investment in software and hardware. Because of the popularity of digital fixed dentures, if the laboratory is equipped with a scanner, there is no need to purchase an additional scanner. However, complete denture design software and printers cannot be avoided. Table 3 lists the cost of a digital light processing printer; a fused deposition modeling printer can be chosen to reduce the cost, but the printing accuracy and efficiency may be reduced.

Although we used the self-controlled study method to exclude the largest variable in edentulous restoration, that is, the influence of individual differences, the sample size was not large enough for a clinical study. Therefore, our study is only a preliminary pilot study. More improvement is expected in FSD technology. Although intraoral scanning cannot obtain the margin morphology of edentulous jaws, and its accuracy cannot fully meet the requirements of denture fabrication, it still can be used for the primary impression. Diagnostic dentures also can be designed with altered morphologies, such as the use of different morphologies of tissue stops and devices designed to set the Gothic arch. If the final denture can be made via multicolor monolithic 3D printing, it will greatly improve the fabrication efficiency of complete dentures. This breakthrough in technology and materials is worth examining.

CONCLUSIONS

FSD can simplify removable complete denture restoration and reduce 2 clinical visits. Compared with conventional complete denture restoration, FSD technology can reduce the clinical and laboratory time and improve the occlusion stability of the final denture. ■

SUPPLEMENTAL DATA

Supplemental data related to this article can be found at https://doi.org/10.1016/j.adaj.2022.09.016.

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