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Evaluation of Dental Implant Stability Utilizing Simplified Versus Conventional Drilling Technique, A Clinical Study

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Abstract
Aim: To evaluate dental implant stability utilizing simplified versus conventional drilling technique and calculating the time of the drilling procedure. **Materials and Methods**: Fourteen patients (9 females and 5 males) received 50 dentium/implantium USA, bone level implants with diameters 3.6 mm, 4.0 mm and 4.5 mm and lengths ranged between 8 mm and 14 mm, divided into two groups, **group A (simplified drilling technique)** in which implants sites were prepared by only the initial and final drill and **group B (conventional drilling technique)** where implants were installed by sequential conventional drilling technique. Implant stability quotient (ISQ) was recorded immediately and 24 weeks after placement of DI. **Results**: No implant was lost during the study follow up appointments with a survival rate of 100%. The primary mean of ISQ value related to implant were installed in mandible was 74.95 and 73.23 for simplified and conventional groups respectively, while after 24 weeks the ISQ value was 80.7 and 79.17 respectively. ISQ values reported no statistically significant difference between the simplified and conventional drilling ($p>0.05$). **Conclusion**: Within the limits of this clinical trial, both drilling techniques produced successful results over a 24 weeks post-insertion follow-up period, however, the simplified drilling technique required less surgical time and lead to less postoperative morbidity.
Keywords: Dental Implant, Stability Utilizing, Conventional Drilling Technique

INTRODUCTION

Implant success and survival depend on many factors, including the drilling sequence and drilling efficiency **(Mihali *et al.*, 2017)**. Nevertheless, the main purpose of drilling is to provide fixation for the implant in the apical portion and/or fixation to the lateral walls of the surrounding bone to obtain primary stability (**Guazzi *et al.*, 2015)** which can be defined as the capacity of implant to withstand loading in axial, lateral and rotational direction **(Sachdeva *et al.*, 2016)**. Implant stability can occur at two different stage, the first stage is the primary mechanical stability which occurs immediately after inserting the implant into the bone while the second one is the progressive increasing in stability related to biologic events at the bone implant interface such as new bone formation and remodeling **(Shadid *et al.*, 2014)**. There are many factors that affect the stability of the implant including factors affecting primary implant stability such as a poor bone quantity and quality have been indicated as the main risk factors for implant failure **(Javed *et al.*, 2013)**, implant factors related to chemical modification of rough implant surfaces can speed up the biological events during the osseointegration process **(Kokovic *et al.*, 2013)** and implant drilling is also a major

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influential factor **(Kim *et al*., 2019)**. There are different methods to assess implant stability. They can be grouped as invasive and noninvasive methods. Resonance frequency analysis (RFA) is noninvasive and the most accurate and precise method **(Sachdeva *et al*., 2016; Swami *et al*., 2015)**. In the process of implant surgery, drilling sequence and speed have been widely known to influence the successful placement of implants. Among these factors, a gradual drilling sequence (conventional drilling) in the formation of the placement location has been considered a fundamental principle. However, using numerous drills at different stages requires time; this has resulted in various negative factors, such as patient discomfort, increased risk of infection, as well as boredom for experts **(patel *et a*l., 2016)**. Several factors influence the success of implants, it would be meaningful to reduce the number of steps in the drilling protocol (simplified drilling) if it does not exert a negative impact on success. Studies addressing this topic have reported that simplification of the drilling process has yielded acceptable results **(Gil *et al*., 2017)**. Simplified drilling consists of the reduction in the number of drills through the use of a pilot drill followed by a final drill (**Guazzi *et al*., 2015)**. This clinical research is focusing on evaluation of dental implant stability utilizing simplified versus conventional drilling technique and calculating the time of the drilling procedure.

MATERIALS AND METHOD

Fourteen patients (9 women and 5 men) with age ranged from 23 - 70 years were enrolled in this study between November 2019 and August 2020 and provided with a written informed consent. This study was approved by the Ethical Committee of the College of Dentistry, University of Baghdad. The patients were selected without any evident systemic or local contraindications such as local acute and chronic infections, periodontal disease, parafunctional habits that interfere with surgery or ossiointegeration process. All implantation sites were chosen according to SAC classification (straightforward cases) with sufficient bone height and width, to insert 50 dental implants (Dentium/Implantium USA) utilizing simplified or conventional drilling techniques.

Surgical procedure

Local anesthesia of the planned surgical field with Lidocaine 2% was performed commencing one tooth before and after the site of implant in maxilla or mandible using infiltration technique. The implant site was exposed either by two or three-sided flap (extensive or limited flap design). In the conventional drilling group, the preparation of the implant bed was carried out with drills of increasing diameter with copious normal saline irrigation and sequential drilling technique according to implant system recommendations using dental engine hand piece set at 800 (rpm) and torque equal to 35 N/cm. on the other hand, in the simplified drilling group, only the initial and final drills were used to prepare the implant's bed. The implants were inserted by a surgical micromotor hand piece with a torque of 35 N/cm and speed 35 rpm as illustrated in figure 1. Seating of DI was completed manually into its final position with the aid of a ratchet. This was followed by subjoining the closer cup according to implant diameter. Wound closer is accomplished utilizing interrupted 3/0 braided black silk sutures.

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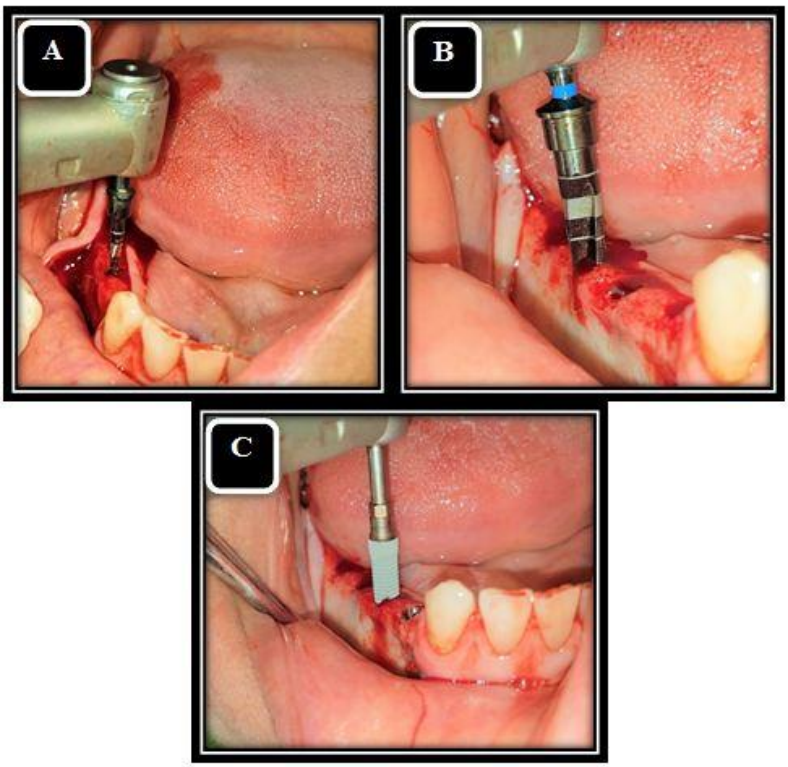

Figure 1: (A) The simplified technique starting with the initial position of implant by pilot drill ⌀2.2 mm. (B) Final drill ⌀4.5 mm. (C) Motorized installation of DI at tooth site #29.

For both groups, the ISQ, acquired using the Osstell Mentor (Sweden) immediately and 24 weeks after placement as illustrated in figure 2. It was applied at two directions mesiodistally and buccolingually for each measurement and the mean value was utilized in the statistical analysis in addition to that, the time of drilling was calculated from the beginning of pilot drill to the end of drilling procedure.

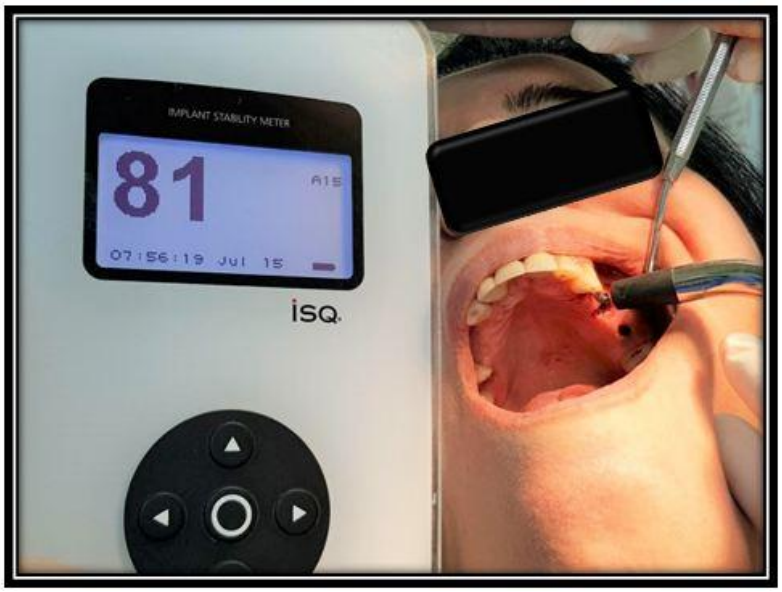

Figure 2: Measurement of the ISQ at the tooth site # 12 using Osstell and smartpeg type 6.

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Follow up and data collection

The sutures were removed 10 days after surgery, the operation site was examined, for postoperative paresthesia, signs of infection, pain and edema. All patients were informed to attend 24 weeks following the healing period for follow up in both groups (A&B) to evaluate the secondary stability in the same way of primary stability. The second stage surgery accomplished with suitable healing abutment which placed for 14 days to be ready for construction of final prosthesis. Orthopantomography illustrate the dental implant after 24 weeks, as in figure 3.

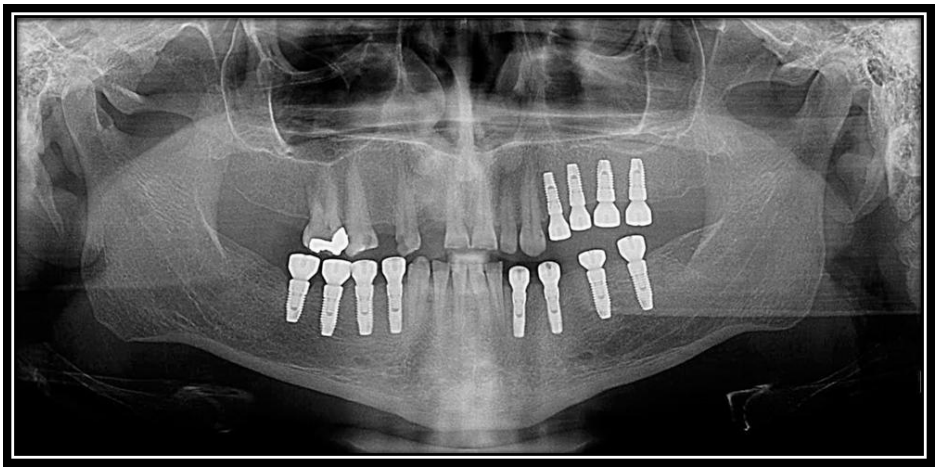

Figure 3: Orthopantomography illustrate the dental implant after 24 weeks

STATISTICAL ANALYSIS

The data analyzed using Statistical Package for Social Sciences (SPSS) version 25. The data presented as mean, standard deviation and ranges. A level of $P<0.05$ was considered significant.

RESULTS

Fourteen patients were contributed to this study in which the age ranged from 23-70 years with an average of 49.57 year and standard deviation (SD) of ± 12.73 year. The highest percentage (64.3%) was registered in females.

A total of 50 implants related to one system (Dentium/implantium, USA) were placed in 14 patients (25 for each group) as clarified in table 1.

Table 1: Descriptive statistics of DI distribution according to the surgical technique and recipient Jaw.

Variable		**Surgical technique**		**Total**
		Simplified	**Conventional**	
		No. (%)	**No. (%)**	**No. (%)**
Jaw	**Maxilla**	**15 (30)**	8 (16)	23 (46)
	Mandible	10 (20)	**17 (34)**	27 (54)

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	Total	25 (50)	25 (50)	50 (100)

In this clinical prospective study, the p value of stability of both simplified and conventional groups between maxillary and mandibular arches reported no significant difference (P>0.05) except the p value of secondary stability in the simplified group was significant (p<0.05) as explained in the table 2.

Table 2: Association of implant stability with drilling technique and recipient jaw.

Jaw		**Groups**		**P value Simplified & conventional**
		Simplified	**Conventional**	
		Mean ± SD	**Mean ± SD**	
Maxilla	Primary	73.73 ± 4.62	75.43 ± 4.77	0.41^
	Secondary	75.76 ± 4.75	80.81 ± 4.45	0.02*
Mandible	Primary	74.95 ± 8.10	73.23 ± 4.59	0.48^
	Secondary	80.7 ± 5.59	79.17 ± 4.29	0.43^
P value (jaw)	Primary	0.63	0.28	
	Secondary	0.02*	0.38	
Maxilla	Primary Secondary	0.03*	0.01*	
Mandible	Primary Secondary	0.04*	**0.00****	

^=not significant at p>0.05, *=significant at p<0.05, **=highly significant at p<0.01.

Drilling Time

Table (3) explain the highly significant difference between time consumed for simplified and conventional drilling techniques.

Table 3: Association of groups and drilling time.

Groups		**P value**
Simplified	**Conventional**	**0.00****
Mean ± SD	**Mean ± SD**	
27.87 ± 7.80	74.88 ± 15.19	

DISCUSSION

In the present research, the mean of **49.57** years and SD of ± 12.73. The percentage **(50%)** was reported ≥**45** years, this is quite ordinary because this is the usual life time for teeth loss which need for dental rehabilitation (dental implant).

The explanation can be borrowed from **Heba & Thair, 2020** who mentioned in their study that the early teeth loss may be related to two major causes, the first one is that the Iraqi patients as other peoples of the 3rd world are suffering from the absence of the preventive care by medical institutes with low educational level in the society and the second one is related to the difficulties of life that make patients being less interested in their dental health.

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In this study, 50 bone level DI were installed with delayed placement protocol, 25 (50%) of them were implanted with a simplified drilling technique and 25 (50%) also were introduced with a conventional one. In the maxillary arch dental implants installed by simplified and conventional drilling techniques were **15 (60%)** and 8 (32%) respectively, while the mandible received 10 (40%) and **17 (68%)** respectively.

This opinion is enforced by **Guazzi *et al.*, 2015** who reported close figure implants distribution, their study included 14 (70%) of DI in mandible utilizing simplified drilling technique while 12 (60%) by conventional one.

In this clinical study, the simplified drilling technique reported a significant increase in the second measurements of ISQ values after 24 weeks in maxillary and mandibular arches while the conventional one reported highly significant increase in secondary stability of DI in mandible only, this is may be due the number of DI that installed in mandibular arch 17 (68%) more than that installed by simplified one 10 (40%) or may be due the density of mandibular bone which positively affect the primary stability and as known it is considered as password of osteointegration.

High primary stability **(ISQ values ≥70)** was successfully gained out by using of simplified drilling technique, this high primary stability may be related to the accuracy in drilling and reducing the errors that may be related to the increasing number of drills.

This explanation is in agreement with **Marheineke *et al.*, 2018** who found higher accuracy of implants sites preparations was generated by single step drill protocols which might result in an increased primary stability. Also, a reduction of the number of drilling steps leads to a reduction of potential sources of errors.

Regarding the high secondary stability associated with osseointegration process after 24 weeks, the simplified drilling offer significant advantages such as less time needed for surgical procedures and surgical site exposure, avoidance of excessive temperature generation, mechanical damage and high frictional forces during surgical drilling, so this enhances bone response to implant.

This is in the same line with **Senada *et al.*, 2020** who reported that simplifications of the conventional gradual drilling result in bone apposition to implants that is comparable with traditional techniques.

The statistical analysis reported that the simplified drilling was associated with a significant increase in the second measurement of ISQ within both of jaws while the conventional one showed significant increase within maxillary arch and highly significant increase in relation to mandibular arch.

The clinical observation reported no significant changes due to the primary and secondary stability remained within the level of high stability (≥ 70).

In the present study, there was a high significant association (P= 0.00) between drilling time required for simplified vs conventional drilling techniques independently of DI dimensions, recipient jaw and zones. The consumed time was greater different in conventional drilling (74.88 ± 15.19 sec) than in simplified one (27.87 ± 7.80 sec).

Guazzi *et al.*, 2015, illustrated in their study, simplification of the drilling sequence reduced operative time by an average of 3.6 min, in addition to the number of complications. In this clinical research the simplification of drilling reduces the drilling timed by an average of **47 sec**.

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CONCLUSION

There was no negative effect on implant stability by reducing the number of drills (simplified technique) during implant site preparation, Therefore, the reduction of the drilling sequence is safe and expected to contribute the improvement of implant related treatments in future. Simplified drilling may lead to excellent outcomes, with advantages for the surgeon in terms of simplification of the implant site preparation technique and speeding up of the surgical procedure, and for the patient as well, due to faster treatment time and decreased postsurgical tissue suffering, which may lead to better acceptance of the implant therapy.

REFERENCES

[1]. Mihali SG, Canjau S, Cernescu A, et al. (2017). Effects of a short drilling implant protocol on osteotomy site temperature and drill torque. *Implant dentistry.* 00(00): 1-6.
[2]. Guazzi P, Grandi T, Grandi G. (2015). Implant site preparation using a single bur versus multiple drilling steps: 4-month post-loading results of a multicenter randomised controlled trial. *Eur J Oral Implantol*. 8(3): 283-290.
[3]. Sachdeva A, Dhawan P, Sindwani S. (2016). Assessment of implant stability: Methods and recent advances. *British Journal of Medicine & Medical Research*. 12(3): 1-10.
[4]. Shadid RM, Sadaqah NR, Othman SA. (2014). Does the implant surgical technique affect the primary and/or secondary stability of dental implants? A systematic review. *International Journal of Dentistry.* 2014 1-17
[5]. Javed F, Ahmed HB, Crespi R, et al. (2013). Role of primary stability for successful osseointegration of dental implants: Factors of influence and evaluation. *Interventional Medicine & Applied Science.* 5 (4): 162–167.
[6]. Kokovic, V, Vasovic, M, & Shafi E. (2014). Assessment of primary implant stability of self-tapping implants using the resonance frequency analysis. *The Saudi Journal for Dental Research. 5*(1): 35-39.
[7]. Kim HM, Cho JY, Ryu J. (2019). Evaluation of implant stability using different implant drilling sequences. *Journal of dental sciences*. 14(2): 152-156.
[8]. Swami, V, Vijayaraghavan V, Swami V. (2016). Current trends to measure implant stability. *The Journal of the Indian Prosthodontic Society*. 16(2): 124.
[9]. Patel A, Gil LF, Castellano A, et al. (2016). Effect of simplified one- step drilling protocol on osseointegration. *International Journal Periodontist*. 36(5): 82-87.
[10]. Gil LF, Sarendranath A, Neiva R, et al. (2017). Bone healing around dental implants: simplified vs conventional drilling protocols at speed of 400 rpm. *Int J Oral Maxillofacial Implants*. 32(2): 329-336.
[11]. Heba MB, Thair AH. (2020). Stability and marginal bone loss of early loaded SLACTIVE implant with flapped and flapless approaches. *International Journal of Medical Dentistry.* 24(1): 71-77.
[12]. Marheineke N, Scherer U, Rucker M, et al. (2018). Evaluation of accuracy in implant site preparation performed in single- or multi-step drilling procedures. *Clin Oral Investing.* 22(5): 2057-2067.
[13]. Senada EA, El Sheikh SA, Khalil MM. (2018). Evaluation of success of single drilling implant system (clinical and radiographical study). *Alexandria Dental Journal*. 45(2): 60-66.