AL-AZHAR
Assiut Dental Journal

The Official Publication of The Faculty of Dental Medicine, Al-Azhar Assiut University, Egypt

AADJ, Vol. 8, No. 1, April (2025) — PP. 29:35
ISSN 2682-2822

Comparative Assessment of Ridge Expansion Using Densah Bur versus Rotary Bone Expanders after Ridge Splitting (Prospective Clinical Study)

Mohamed Ahmed Mohamed [*1], Ashraf Fathy Mohamed, Tarek Abdelbary Abdellatife

Codex : 04/2025/04

Aadj@azhar.edu.eg

ABSTRACT

Aim: This study aimed to evaluate and compare changes in alveolar ridge width using two techniques—Densah Bur and rotary bone expanders—after ridge splitting, assessed through cone beam computed tomography (CBCT).**Subjects and methods:** A prospective randomized clinical study included six patients (twelve sides) requiring implants. The split-mouth technique assigned one side of each patient to the Densah Bur (Group I) and the other to rotary bone expanders (Group II). Twenty-four implants were placed, with evaluations conducted at baseline and 6 months. **Results:** Both groups demonstrated significant increases in ridge width from baseline to 6 months ($p < 0.001$). Group I increased from 4.43 mm to 6.29 mm, and Group II from 4.25 mm to 6.24 mm. No statistically significant differences were noted between the two techniques ($p > 0.05$). **Conclusion:** Densah Burs and rotary bone expanders are effective for ridge splitting with simultaneous implant placement, yielding comparable results in ridge width augmentation.

KEYWORDS

Ridge expansion, Densah Bur, Rotary Bone Expanders, Ridge Splitting.

INTRODUCTION

The use of dental implants has expanded the possibilities of oral rehabilitation, particularly for edentulous patients[1]. Successful implant placement relies on adequate alveolar bone volume, which ensures primary stability—a key predictor of long-term success.[2]

Alveolar ridge deficiencies often necessitate augmentation techniques, including guided bone regeneration (GBR), osteotome expansion, and ridge splitting[3]. The alveolar ridge splitting technique (ARS), first introduced by Tatum in 1986[4], has since undergone numerous refinements to improve outcomes and reduce invasiveness.[5]

Recent advancements include rotary bone expanders and Densah Burs[6]. Rotary bone expanders provide a gradual expansion of the ridge[7], while Densah Burs combine ridge expansion with osseodensification(8), enhancing bone density and implant stability[9]. Despite the widespread adoption of these techniques, comparative studies assessing their effectiveness remain limited[10]. This study aims to evaluate ridge width

1. Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Minia University, El Minia, Egypt.

* Corresponding Author e-mail: drtarekabdelbary05@gmail.com

changes achieved using Densah Burs versus rotary bone expanders following ridge splitting.

PARTICIPANTS AND METHODS

Study Design:

This prospective randomized clinical study was conducted on six patients with horizontal bone defects requiring dental implant placement.

Sample Size Calculation:

Sample size estimation was performed using G*Power software (v3.1.9.7)(8), which determined that 24 implants (12 per group) would provide sufficient statistical power.

Ethical Considerations:

Approval for the study was granted by the Minia University ethical committee (ID: 89/628, 2022). Written informed consent was obtained from all participants after explaining the study's protocol and associated risks.

Inclusion Criteria:

- Patients aged 30–50 years with bone types D2 or D3.
- Ridge widths of 4–5.5 mm and heights ≥10 mm.
- Adequate inter-arch space for implant placement.

Exclusion Criteria:

- Heavy smokers or patients with untreated periodontal disease or acute oral infections.
- Patients with uncontrolled systemic conditions, history of head/neck radiotherapy, or prior treatment with anti-resorptive drugs.
- Pregnant or breastfeeding women.

Patient Grouping:

The split-mouth technique was applied to each patient. One side was randomly assigned to Group I (Densah Bur) and the other to Group II (rotary bone expanders) using a coin-flip method.

SURGICAL INTERVENTION

Presurgical Preparation:

Patients underwent a detailed case history review and general health assessment. Preoperative imaging, including screening panoramic radiographs and CBCT, was performed to evaluate ridge dimensions and locate anatomical landmarks.

Prophylactic antibiotics (amoxicillin-clavulanate, 1 g) were prescribed one day before surgery, and chlorhexidine mouthwash was used immediately prior to the procedure.

Surgical Protocol:

1. Anesthesia and Flap Reflection:

Local anesthesia with 4% articaine (1:100,000 epinephrine) was administered. A crestal incision was made, and full-thickness flaps were reflected to expose the surgical site.figure(1)

2. Crestal Osteotomy:

Horizontal and vertical osteotomies were performed using a piezoelectric device or surgical disc, cutting through the cortical bone to the cancellous layer. Figure(1)

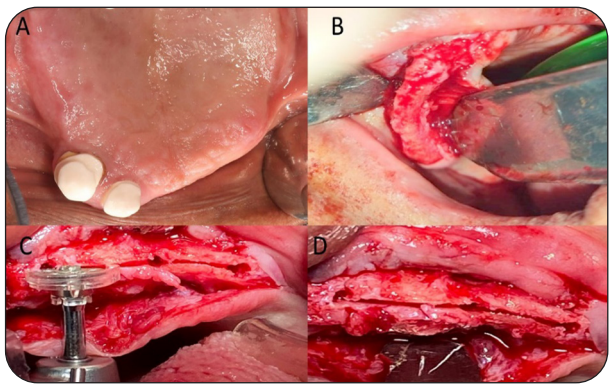

Fig. (1) (a) Pre operative. (b) Full thickness flab reflection. (c,d) Site preparation with initial drill and crestal splitting with surgical disc.

3. Ridge Expansion:

- **Group I (Densah Bur):** Sequential counter-clockwise drilling at 800 RPM was performed using progressively larger Densah Burs in densifying mode. This expanded and compacted the bone to accommodate the implant. Figure (2)

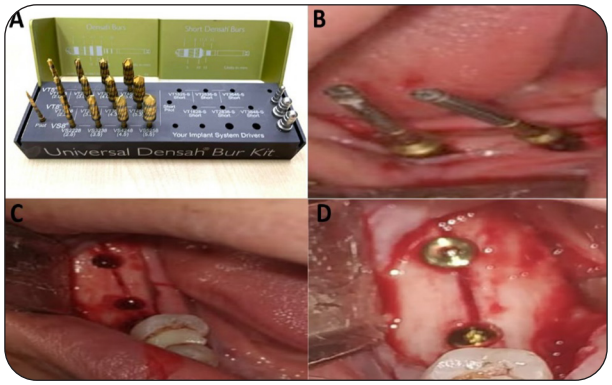

Fig. (2) (A) Densah burs kit. (B,C): Ridge expansion and drilling at implant site. (D) Implant placement

- **Group II (Rotary Bone Expanders):** Sequential clockwise drilling at 25–35 RPM using rotary bone expanders was performed, gradually increasing the osteotomy diameter. Figure (3)

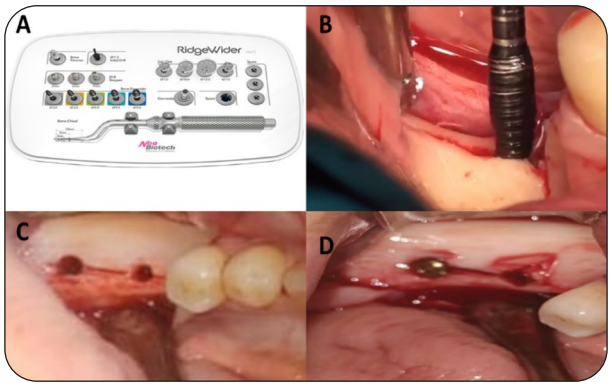

Fig. (3) (A) Rotary bone expanders kit. (B,C) Ridge expansion with expanders and drilling at implant site. (D) Implant placement

4. Implant Placement:

Implants (Flotecno, wide and double-threaded) were placed per manufacturer instructions, ensuring primary stability. Flaps were sutured using continuous locking sutures with 4-0 polypropylene material. Figure (5)

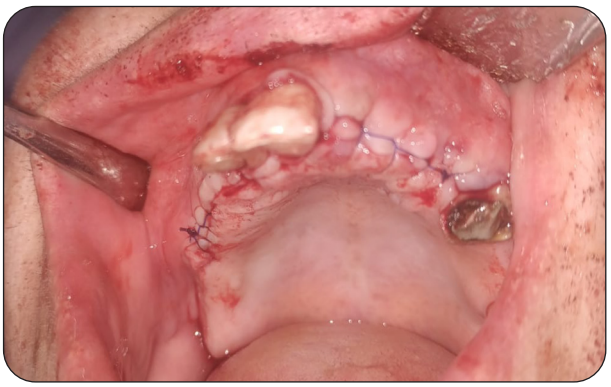

Fig. (4) Closure of the flap using continous with lock sutures

POST-SURGICAL CARE:

Postoperative Instructions:

Patients were instructed to:

- Use cold compresses externally on the first day.
- Rinse with chlorhexidine mouthwash (0.125%) twice daily for one week.
- Avoid trauma to the surgical site and adhere to a soft diet.

Medications:

- Amoxicillin-clavulanate (1g) twice daily for 5 days.
- Metronidazole (500mg) every 8 hours for 5 days.
- Diclofenac potassium (50 mg) every 8 hours for 5 days for pain management.

Follow-Up:

Sutures were removed 7–10 days postoperatively. Patients were monitored weekly for the first 3 weeks and subsequently at 3 and 6 months.

RESULTS

Demographic Data:

- Total patients: 6 (4 females, 2 males).
- Mean age: 40 ± 5 years.
- Total implants: 24 (5 in maxilla, 1 in mandible).

Table 1. *Demographic Data of Study Participants*

Parameter	Details
Total Cases	6 (5 cases in maxilla, 1 case in mandible)
Mean Age (± SD)	40 ± 5 years
Gender Distribution	2 males, 4 females
Total Implants	24 implants

Ridge Width Measurements

- **Group I (Densah Bur):** Ridge width increased from 4.43 ± 0.58 mm to 6.29 ± 0.68 mm after 6 months. Table (2) figure (6)
- **Group II (Rotary Bone Expanders):** Ridge width increased from 4.25 ± 0.72 mm to 6.24 ± 0.75 mm after 6 months. Table (2) figure (6)

Table 2. *Ridge Width Measurements for Group I (Densah Bur) and Group II (Rotary Expander) Before Surgery and After 6 Months*

Time Point	Category	Group I	Group II	Test Result
Before Surgery	Mean ± SD	4.43 ± 0.58	4.25 ± 0.72	t=0.655, p1=0.519
	Median (Min-Max)	4.55 (3.22-5.50)	4.35 (3.22-5.50)	
After 6 Months	Mean ± SD	6.29 ± 0.68	6.24 ± 0.75	t=0.162, p1=0.873
	Median (Min-Max)	6.19 (5.40-7.49)	6.10 (5.20-7.99)	
Same Group Pairwise Comparison		p2 <0.001*	p2 <0.001*	

t*: Student t-test,* **p2***: Pairwise comparison (before surgery vs. after 6 months) within each group, pairwise comparisons used paired t-test,* ***** *for significant p value*

Statistical analysis revealed significant increases in ridge width within both groups ($p < 0.001$). However, no significant differences were observed between the two groups at any time point ($p > 0.05$).

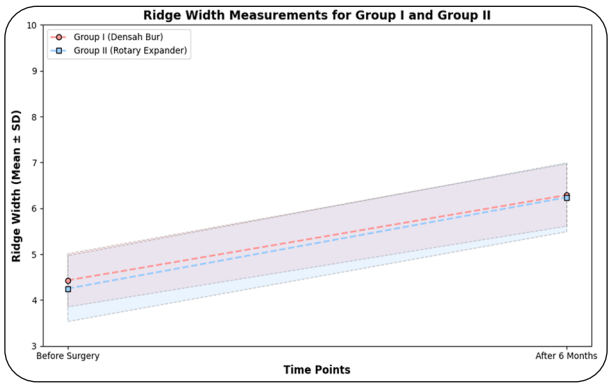

Fig. (5) Ridge Width Measurements for Group I (Densah Bur) and Group II (Rotary Expander) Before Surgery and After 6 Months

DISCUSSION

Dental implants have revolutionized oral rehabilitation by enabling functional and esthetic restoration in edentulous patients. However, sufficient bone volume is critical for achieving primary implant stability, which is essential for long-term success[11]. Alveolar ridge deficiencies often present a significant challenge[12], necessitating augmentation techniques to increase ridge dimensions.[13]

This study evaluated and compared two ridge expansion techniques: Densah Bur and rotary bone expanders. Both methods demonstrated significant increases in ridge width after 6 months, with no

statistically significant differences between the two techniques ($p > 0.05$). These findings support the null hypothesis that no difference exists between the outcomes of the two methods.

The use of Densah Burs facilitates ridge expansion while simultaneously increasing bone density through osseodensification[14]. This biomechanical preparation method compacts bone, preserving its integrity and enhancing primary stability[15]. Previous studies have highlighted its benefits, including increased bone-to-implant contact and accelerated healing. Similarly, rotary bone expanders provide controlled horizontal expansion, increasing ridge dimensions while maintaining simplicity and cost-effectiveness.[16]

The results align with prior research demonstrating the effectiveness of ridge expansion techniques in augmenting ridge width without the need for invasive bone grafting. Studies by Misch et al. (2014)[17] and Elian et al. (2011)[18] reported comparable outcomes, with significant improvements in ridge dimensions during the early stages of healing and remodeling. This stabilization phase is critical, as primary bone formation occurs within the first few months, followed by slower secondary remodeling.[19]

The clinical implications of this study are significant, particularly for cases where narrow ridges would otherwise preclude implant placement. Both techniques offer reliable options for ridge expansion, with the choice of method dependent on clinical preference, patient-specific factors, and cost considerations.

While both methods proved effective, limitations of the study include the small sample size and the short follow-up duration. Future studies with larger cohorts and extended observation periods are recommended to further validate these findings and explore long-term outcomes.

CONCLUSION

Both Densah Burs and rotary bone expanders are effective and reliable techniques for ridge splitting with simultaneous implant placement. Both methods achieved significant and comparable increases in ridge width after 6 months, with no statistically significant differences between them.

The choice of technique may depend on operator preference, patient-specific considerations, and cost. These findings provide valuable insights for clinicians seeking predictable and efficient methods for alveolar ridge augmentation.

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النشر الرسمي لكلية طب الأسنان
جامعة الأزهر أسيوط
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AADJ, Vol. 8, No. 1, April (2025) — PP. 35

تقييم مقارن لتوسيع الحافة باستخدام مثقاب دينساه مقابل موسعات العظام الدوارة بعد شق الحافة دراسة سريرية مستقبلية

محمد احمد محمد*، اشرف فتحى محمد، طارق عبد الباري عبداللطيف

1. قسم جراحة الفم والوجه والفكين ، كليه طب الاسنان جامعه المنيا، مصر
* البريد الإلكتروني: DRTAREKABDELBARY05@GMAIL.COM

الملخص :

الهدف: هدفت هذه الدراسة إلى تقييم ومقارنة التغيرات في عرض الحافة السنخية باستخدام تقنيتين - مثقاب دينساه وموسعات العظام الدوارة - بعد انقسام الحافة. وتم تقييمها من خلال التصوير المقطعي المحوسب بالحزمة المخروطية (CBCT).

المواد والاساليب شملت دراسة سريرية عشوائية مستقبلية ستة مرضى (اثني عشر جانبًا) يحتاجون إلى غرسات في تقنية الفم المنقسم. تم تخصيص جانب واحد من كل مريض لمثقاب دينساه (المجموعة الأولى) والآخر لموسعات العظام الدوارة (المجموعة الثانية). تم تركيب أربعة وعشرين غرسة. وأُجريت التقييمات في بداية الدراسة وبعد ستة أشهر.

النتائج: أظهرت كلتا المجموعتين زيادات ملحوظة في عرض الحافة من بداية الدراسة وحتى ستة أشهر (قيمة الاحتمال < 0.001). زاد عرض الحافة في المجموعة الأولى من 4.43 ملم إلى 6.29 ملم. وفي المجموعة الثانية من 4.25 ملم إلى 6.24 ملم. لم تُلاحظ أي فروق ذات دلالة إحصائية بين التقنيتين (قيمة الاحتمال < 0.05).

الخلاصة: تُعدّ مثاقب دينساه وموسعات العظام الدوارة فعّالتين في شقّ التلال مع زرع الزرعات في وقت واحد. مما يُعطي نتائج مماثلة في زيادة عرض التلال.

الكلمات المفتاحية : توسيع حافة الفك، مثاقب دينساه، موسعات العظام الدوارة، شقّ حافة الفك.