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Evaluation of the APTUS ADAPTIVE 2 Distal Radius Plate: A series of 21 cases with distal radius fractures

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Abstract: Objective: The APTUS ADAPTIVE 2 Distal Radius Plate is a newly developed implant used to treat distal radius fractures. It is considered to offer several improvements over implants from previous generations. This study aims to highlight the advantages and disadvantages of this implant based on our clinical experience.

Subjects and Methods: Twenty-one patients (5 males and 16 females; mean age, 67.4 years) with distal radial fractures who underwent surgical treatment using the Adaptive 2 Distal Radius Plate were included. Radiographic parameters, including volar tilt, radial inclination, ulnar variance, and Saito's demerit point system, were evaluated. Statistical analyses were performed using the paired t-test.

Results: The implants were successfully placed in all patients without difficulty, and no complications were reported during the follow-up period. The mean correction losses of radial inclination, volar tilt, and ulnar variance at 6 months postoperatively were 0.2°, 0.3°, and 0.4 mm, respectively. According to Saito's demerit point system, 13 cases were rated "Excellent," and eight were rated "Good," indicating that the plate is as reliable as the previous models.

Conclusion: Overall, this new plate appears to be a viable option for treating distal radius fractures with few notable limitations. However, improvements over previous plates may not significantly affect clinical outcomes.

Key words: Distal radius fractures / ADAPTIVE 2 Distal Radius Plate /
Clinical outcomes

Introduction

In recent years, volar plates have emerged as the standard implant for internal fixation of distal radius fractures^{1, 2)}. Although various volar plates with different designs are currently available depending on the fracture type, previous studies have shown that polyaxial locking plates are among the most effective fixation devices^{3, 4)}. The APTUS ADAPTIVE 2 Distal Radius Plate (hereafter referred to as the Adaptive 2 Plate) is a newly designed volar plate that was introduced to the market in 2017. It was redesigned from its predecessor to better fit the distal radius and allow placement along the

watershed line. However, few studies have reported the use of this implant. The aim of this study was to evaluate the clinical outcomes of this device and to discuss its characteristics in comparison with previously reported values in the literature.

Materials and Methods

This study included 21 patients with distal radius fractures treated with the Adaptive 2 Plate between January 2017 and December 2023 at our institution and affiliated hospitals, with a minimum follow-up of 6 months. The cohort comprised 5 males and 16 females, with a mean

age of 67.4 ± 18.9 years. Fractures occurred on the right side in nine cases, whereas on the left side in 12 cases. Based on the Arbeitsgemeinschaft für Osteosynthesefragen (AO) classification, the cohort included three cases of type A2, five cases of A3, two cases of B3, five cases of C1, four cases of C2, and two cases of C3. There was no apparent variation in fracture types among the cases. Surgery was performed using a volar approach in all cases. The pronator quadratus muscle was preserved in its proximal two-thirds, and the plate was inserted beneath it for fixation. Volar tilt (VT), radial inclination (RI), and ulnar variance (UV) were assessed using plain radiographs at three time points: preoperatively, immediately after surgery, and 6 months postoperatively. Furthermore, on postoperative lateral radiographs, the distance between the radius and the plate was measured in 1-mm increments. Clinical outcomes were evaluated using Saito's demerit point system (Saito's score), which incorporates both subjective evaluations, such as pain and disability, and objective measures, including residual deformity, range of motion, grip strength, and arthritic changes. The outcomes were classified as "Excellent (0–3 points)," "Good (4–9)," "Fair (10–15)," or "Poor (16–26)." For the assessment of patient-reported pain, the Numerical Rating Scale (NRS) was employed, whereby patients were asked to rate their pain intensity on an 11-point scale ranging from 0 (no pain) to 10 (worst imaginable pain). Statistical analyses were performed using the paired t-test. All values are presented as mean $\pm$ standard error of the mean. Statistical significance was defined as p -value < 0.05 . The sample size was limited due

to the gradual clinical introduction of this new device. Therefore, this study was designed as a descriptive case series to evaluate initial safety and efficacy, rather than a comparative study with a control group.

Results

Bone union was achieved in all the cases. The preoperative VT, RI, and UV were $-8.8 \pm 15.3^\circ$, $16.6 \pm 5.1^\circ$, and 2.5 ± 1.9 mm, respectively. Six months postoperatively, the mean correction losses for VT, RI, and UV were 0.2° , 0.3° , and 0.4 mm, respectively. No significant differences were observed in these values recorded immediately after surgery and those at 6 months postoperatively, indicating that fracture reduction and fixation were well maintained (Table 1). In all cases, the distance between the radius and the plate was 0 mm. Thirteen cases were rated as "Excellent" and eight as "Good" based on Saito's score. Sex and age were not associated with the clinical outcomes in our cohort. The preoperative NRS was 8.4 ± 0.9 , while the postoperative NRS was 0.2 ± 0.4 , demonstrating a significant improvement.

Case Presentation

A 66-year-old woman sustained a distal radius fracture of the left wrist after falling on the street (Figure 1; AO classification type C1). Three days after the injury, surgery was performed using the Adaptive 2 Plate under general anesthesia (Figure 2). A splint was applied for 1 week postoperatively, followed by range-of-motion exercises. Bone union was confirmed using radiographic examination 3 months postoperatively.

Table 1. Radiographic evaluation (mean $\pm$ standard error of the mean)

Parameter	Immediate Postoperative	At 6 Months Postoperatively	p-value
VT	$10.7 \pm 5.4^\circ$	$10.5 \pm 5.7^\circ$	0.89
RI	$22.9 \pm 3.9^\circ$	$22.6 \pm 4.2^\circ$	0.82
UV	-0.1 ± 1.7 mm	0.3 ± 1.6 mm	0.35



Figure 1.

Radiographs taken at the initial visit at the initial hospital visit (left, anteroposterior view; right, lateral view). A distal radius fracture with dorsal displacement is observed.

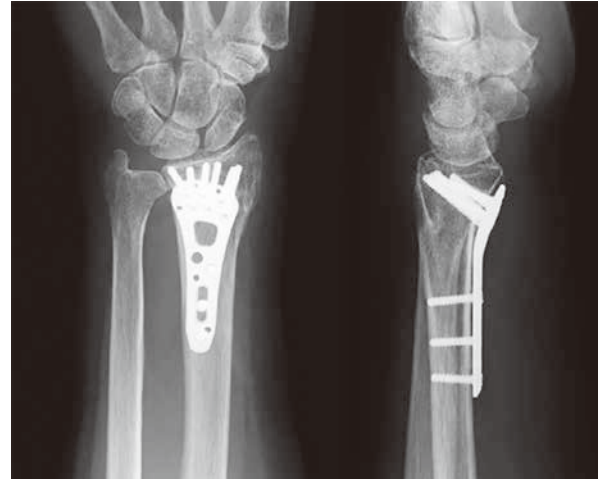


Figure 3.

Radiographs taken 6 months after surgery (left, anteroposterior view; right, lateral view). The fracture reduction is well maintained.

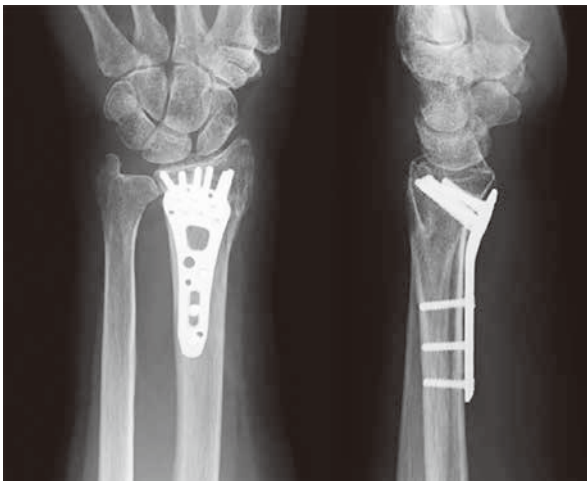


Figure 2.

Postoperative radiographs (left, anteroposterior view; right, lateral view). Anatomical reduction and rigid plate fixation have been achieved.

Six months postoperatively, radiographs showed no correction loss in VT and RI, whereas UV demonstrated a correction loss of 1 mm (Figure 3). The patient reported only mild discomfort, with no associated pain or disability. Wrist range of motion was as follows: extension, 40°; flexion, 60°; supination, 45°; pronation, 60°; radial deviation, 15°; and ulnar deviation, 45°. According to Saito's score, the clinical outcome was rated as "Good." The patient returned to clerical duties 1 month postoperatively.

Discussion

Volar locking plates are considered the standard implants for distal radius fractures⁵⁾. A wide variety of volar locking plates differ in concept and design⁶⁾, and, in general, they yield satisfactory outcomes with low complication rates⁷⁾. The Adaptive 2 Plate is a newly developed polyaxial locking plate in the APTUS series. It was designed to fit the radius anatomically and be positioned along the watershed line. In particular, it is shaped to match the slight prominence of the distal ulnar side of the radius, providing an excellent fit and stability. Our patients achieved either "Excellent" or "Good" results on Saito's score, with minimal reduction loss at 6 months postoperatively, suggesting that the Adaptive 2 Plate is comparable to, if not superior to, other volar plates commonly used in clinical practice.

Previous studies have shown that former APTUS series plates have a very low incidence of complications, such as fixation failure or device malfunction, with favorable wrist function outcomes. Biondi et al. reported clinical outcomes of 68 patients treated with APTUS series plates, with an average follow-up of 34.1 months. They observed a mean pain score of 1.8 on the visual analog scale and a mean Disability

of the Arm, Shoulder, and Hand score of 6.6⁸⁾. Although the APTUS plate does not present any major issues, it is not an anatomical plate; therefore, it may not achieve a perfect fit to the bone during surgery, and there is a possibility of uncertainty regarding the optimal placement position. However, since the position of the plate can be adjusted to some extent, it can also be described as offering flexibility in placement. However, there have been reports of postoperative carpal tunnel syndrome in some cases with APTUS plates, where symptom improvement was achieved through plate removal and decompression. Therefore, it is suggested that there may be a potential concern regarding slight morphological incompatibility⁹⁾. Although our cohort was relatively small, we did not encounter these issues in any of our cases, suggesting that the Adaptive 2 Plate may offer improvements over the former versions in this respect. Furthermore, as it is a polyaxial plate, screws can be inserted into optimal positions with relative ease.

The potential disadvantages of the Adaptive 2 Plate include technical complexity and prolonged fluoroscopy time during surgery, which are common issues shared with other volar locking plates¹⁰⁾. In addition, as with other anatomical plates that can only be placed in a specific position on the bone, flexibility in plate positioning is somewhat limited compared with that of non-anatomical plates. However, in our experience, these limitations are inconsequential as long as satisfactory fracture reduction is achieved during surgery.

Overall, the Adaptive 2 Plate is a well-designed plate with improvements over previous-generation plates, including anatomical contours and polyaxial screws. It can be used for most distal radius fractures, with satisfactory clinical outcomes. However, considering that the previous generation of volar plates was already highly perfected with no major shortcomings, the advantages of the Adaptive 2 Plate over

previous models may not be appealing to all surgeons, especially those with established preferences. These are not matters of superiority or inferiority, but rather reflect the inherent characteristics of each.

Nevertheless, the Adaptive 2 Plate represents a valuable option for early-career and experienced surgeons.

Conclusion

The Adaptive 2 Plate appears to be a well-designed and versatile implant, representing an effective treatment option for patients with distal radius fractures.

Ethics Statement

This study was conducted in accordance with the ethical standards of the Declaration of Helsinki and approved by the Ethics Committee of the National Defense Medical College, Japan (Approval No. 5314). All participants provided written informed consent prior to their inclusion in the study.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

HK analyzed and interpreted the patient data. TI helped the clinical treatment. KH was a major contributor to writing the manuscript. All authors read and approved the final manuscript.

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None.

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APTUS ADAPTIVE 2 橈骨遠位端プレートの評価 —橈骨遠位端骨折21症例の検討—

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要旨：【目的】APTUS ADAPTIVE 2 (Adaptive 2) プレートは、橈骨遠位端骨折用の新しいプレートであり、過去のプレートに比べていくつかの改良が加えられている。本研究では、我々の臨床経験に基づき、このプレートの利点と欠点を明らかにすることを目的とした。

【方法】橈骨遠位端骨折に対して Adaptive 2 プレートを用いて外科的治療を行った21例（男性5例，女性16例，平均年齢67.4歳）を対象とした。評価項目は、単純X線での術直後と最終診察時のVolar tilt (VT), Radial inclination (RI), Ulnar variance (UV) とThe demerit point system of Saito(斎藤の評価)である。統計学的検討は、対応するt検定を用いた。

【結果】全症例においてインプラントは問題なく設置され、経過観察期間中に合併症は認められなかった。術後6か月の平均矯正損失はVTが 0.2° ，RIが 0.3° ，UVが 0.4 mm であり、整復位は良好に維持されていた。斎藤の評価でexcellentが13例，goodが8例と良好な成績であった。

【考察】Adaptive 2 プレートは、橈骨遠位端骨折の治療において有用な選択肢となり得る。

索引用語： 橈骨遠位端骨折 / ADAPTIVE 2 Distal Radius Plate / 臨床成績