

Results of percutaneous fixation of fresh scaphoid fractures

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Abstract

Background: Fractures of scaphoid are prevalent, and many times are difficult to identify and heal. Fracture scaphoid may cause extended morbidity and absences from work in young adult in which they are most prevalent. Non displaced fractures of the scaphoid waist were handled with immobilization as conventional therapy, with possibly resulting reduction of wrist motion . include extended cast immobility, and constitute a severe economical hardship. Immobilization may be required for up to 3 months, and patient compliance is therefore generally poor, particularly in the presence of low symptom levels, when plasters may be removed early, resulting in delayed union or nonunion. For nonoperative therapy of acute scaphoid waist fractures, numerous forms of casts are utilized in normal practice. These include Colles' cast with wrist in flexion or extension; scaphoid cast below or above elbow; scaphoid cast including or omitting the thumb. This research aims at examining the efficiency of percutaneous cannulated Herbert's screw repair of new scaphoid fractures in providing good result. Methods: Fifteen patients with new scaphoid fractures repaired with percutaneous Herbert screw were included in this investigation. This research was done at Banha university hospital and Kafr El-Sheikh general hospital between October 2019 and August 2020. These patients were followed up for an average of 10 months (8-12 months) post-operatively. This research covered non-displaced or mildly displaced complete waist fractures (B2) according to Herbert's classification. We utilized volar technique in all situations. Results: The clinical findings were assessed as outstanding in 12 patients (80 percent) and good in 3 individuals (20 percent). (20 percent). By the conclusion of the follow up period 12 patients (80 percent) had no pain at all, and 3 patients (20 percent) experienced minor intermittent discomfort. Twelve patients (80 percent) restored wrist range of motion with flexion & extension higher than 120 degrees, two patients (13.3 percent) regained mobility between 119 to 110 degree, and one patient (6.7 percent) regained motion between 90 to 99 degrees. Thirteen patients (86.7 percent) have 90 percent to 100 percent grip strength compared to the normal side, two (13.3 percent) patients has 75 percent to 89 percent grip strength compared to the normal side. Comparing the functional end outcomes with smoking, no significant association was identified. ($P>0.05$ statistically insignificant). Significant association was established between central location of the screw and the functional end outcomes, ($P<0.05$ statistically significant). The fixation group contained 11 and the cast group 14 patients. The cast group was immobilized in a long cast for 6 weeks, followed by a short cast until union was attained, which was verified clinically and radiographically. The fixation group was immobilized with a brief cast for 10 days and a detachable splint till union. All patients were followed up for 25 months, and all fractures attained union. Analysis demonstrated substantial decrease in time to union in the fixation group (7 vs. 12 weeks, $p = 0.0003$) and time to return to full duty in the fixation group (8 vs. 15 weeks, $p = 0.0001$). There was no significant link between age and time to union, ($P>0.05$ statistically insignificant). Significant connection was established between smoking and time of fracture union, ($P<0.05$ statistically significant). No Significant connection was established between the time of union and time elapsed before operation, ($P>0.05$ statistically insignificant). Significant association was established between central location of the screw and the time of union outcomes, ($P<0.05$ statistically significant). Regarding complications in this research, screw protrusion was detected in one instance however there was no major influence on the clinical result according to MMS score. Localized osteopenia as a symptom of reflex sympathetic osteodystrophy occurred in one patient with concomitant fracture distal radius owing to immobilization and was amenable to physiotherapy after removal of cast and k-wire. Superficial skin infection developed in one patient treated with daily dressing and antibiotics and the infection disappeared after 5 days. There was no nonunion, no delayed union, and no loosening of screw. Conclusion: Percutaneous screw fixation of minimally or non-displaced scaphoid waist provides a stable mode of osteosynthesis which allows for reduced time to bony union with consequent earlier return to sports or employment with minimized loss of motion, grip strength, and muscle atrophy attributed to prolonged cast immobilization. Using the volar approach, it is simple to establish and sustain reduction, better identification of the bone landmarks and easier interpretation of the fluoroscopically produced pictures.

Key words: percutaneous fixation, fresh scaphoid fractures.

1. Introduction

Fifty to eighty percent to one-tenth of all carpal bones and around 11 percent of all hand injuries are caused by breaks in this bone, which is most typically seen in young, active people. Scaphoid fracture is the most common scaphoid fracture location, accounting for 80% of all fractures. A fall onto a hyperextended wrist, which results in longitudinal stress of the scaphoid, and a subsequent failure of the dorsal cortex

on compression, is the most common cause of these fractures. The scaphoid is particularly vulnerable to wrist-injury-inducing sports like football and basketball. Scaphoid fractures have a bad reputation for being difficult to diagnose and much more difficult to treat after they have occurred. The most typical clinical tests for scaphoid fractures are tenderness in the anatomical snuffbox, pain on palpation of the scaphoid tubercle, discomfort with axial compression

of the thumb, and painful thumb range of motion. Patients who are suspected of having a scaphoid fracture should have their wrists x-rayed at the time of their first examination. MRI is the imaging modality of choice for the identification of occult fractures, bone contusions, and related soft tissue injuries if radiographs are negative. Scaphoid fractures have been classified in a variety of ways, but the Herbert and Fisher method is the most often used. Anatomic location, fracture displacement, comminution, and activity or profession of the patient are all variables that influence the treatment of an acute scaphoid fracture [6]. It is common practise to treat undisplaced, stable fractures with 8-12 weeks of cast therapy, until they heal. If you want to engage in professional or sports-related activities or for social reasons, this may be rejected by the younger, more active population [8]. Additionally, cast immobilisation has drawbacks like as stiffness and reduced hand grip.

Displaced fractures are treated surgically with open reduction and internal fixation due to the possibility of non-union and avascular necrosis.

Damage to the anterior radiocarpal ligaments is common with open fixation, as is infection and severe scarring after the procedure. Reflex sympathetic dystrophy, however, is a potentially fatal condition. (9) Another option for nondisplaced scaphoid fractures is percutaneous fixation of the scaphoid, initially described in 1970 by Strelt. It is possible that the percutaneous method will reduce morbidity, speed up recovery, protect the scaphoid's already fragile blood supply, and shorten the time it takes for the bones to fuse. The surface of the scaphoid bone is covered with articular cartilage, which limits the number of places where fixation devices may be inserted. Percutaneous cannulated Herbert's screw repair of new scaphoid fractures was the primary objective of this investigation.

2. Patients and Methods

A-Patients:

This study included 15 patients (12 males, 3 females and their ages range from 21 years to 50 years with an average of 35) with closed scaphoid fractures

Present history:

Date of trauma.

• Date of admission.

• Mechanism of injury.

• Present medical history

treated between October 2019 and August 2020 at Banha university hospital and Kafr-Elsheikh General Hospital with volar percutaneous fixation method. The period of follow up ranged from 8 to 12 months with an average of 10 months.

Patient's selection:

Inclusion criteria

- Patient's age: 18-50 years old
- Closed injuries.
- Mean time from injury to surgery 2 weeks
- Non displaced or minimally displaced less than 2mm

Exclusion criteria:

- Open fractures.
- Comminuted fractures.
- Scaphoid Fracture Delayed Union or Non-Union.
- Pediatric fractures (age under 18).
- Displaced fracture

3) Mechanism of injury:

4) Classification of fractures:

According to the Herbert classification all cases were classified as B2 (complete waist fracture).

Methods

Preoperative management protocol:

Ethical consideration

- Full counseling of participants in this research and informed consent was obtained with full Privacy of participants and confidentiality of the data.
- On admission, all patients were subjected to history taking, clinical examination and laboratory investigations.
- In case of any unexpected risks appearing during the course of the research it was cleared to participants and to the ethical committee.
- The privacy of participant and confidentiality of the data were given the most care and attention .each patient data file including investigation will be code assigned and only the code was used in data management without disclosure of its name or personal information.

Personal history:

- Name, Age, Sex, Residency, Occupation, Phone number and Smoking

Table (8) the cause of fractures was fall on out stretched hand (FOOSH) in 12 cases (80%) and motor vehicle accident (M.V.A) (20%) in 3 cases.

| Mechanism of injury | Number | Percentage |
|---------------------|-----------|-------------|
| FOOSH | 12 | 80% |
| M.V.A | 3 | 20% |
| Total | 15 | 100% |

Table (8) mechanism of injury

Clinical examination:**General examination:**

- Full examination for associated injury.
- Blood pressure, Pulse, Temperature, Respiration & other body systems.

Local examination:

- Inspection: deformity, skin condition and presence of wound or associated injuries.
- Palpation: skin temperature, anatomical snuffbox tenderness (ASB); scaphoid tubercle tenderness (ST); pain on longitudinal compression of the thumb (LCT) **Figure (1).**

(ASB); (B) scaphoid tubercle tenderness (ST); (C) pain on longitudinal compression of the thumb (LCT).
(12)

- Distal neurovascular status (compartment syndrome or entrapment neuropathy)
- ROM(range of motion)

Radiological examination:

- Plain X-ray (Antero-posterior, Lateral and scaphoid views) of the scaphoid
- CT scan if needed.

Laboratory investigations:

- CBC
- Liver function test& Renal function test
- Random blood sugar
- PT.PTT.INR

C) Method of clinical and functional assessment**Early postoperative:**

Wound care, examination for hand edema and capillary circulation. Motion was allowed as tolerated at the wrist but full range of motion of the fingers was achieved immediately. Supplementary K wires used for fixation of the distal radius were removed at 6 weeks.

Radiological evaluation:

Postoperative X-rays were examined for fracture site compression, screw position e.g. clearance of the scaphotrapezial joint from the screw head and leading threads not penetrating the dorsal cortex into radioscapoid articulation, screw direction and its relation to the plane of the fracture and assessment of the proper management of associated injuries. Serial radiological examinations at 4 and 6 weeks and every week after till union

Assessment of union:

Absence of fracture site tenderness and trabeculae that cross the fracture site in plain X-ray and CT used as signs of union.

Late post-operative:**Radiological examination:**

At 6 months follow up for assessment of screw position, carpal alignment and evidence of complications; arthritis or nonunion.

Data management and statistical analysis

Data were collected, coded, revised and entered to the Statistical Package for Social Science (IBM SPSS) version 20. The data were presented as number and percentages for the qualitative data, mean, standard deviations and ranges for the quantitative data with parametric distribution and median with inter quartile range (IQR) for the quantitative data with non-parametric distribution.

Chi-square test was used in the comparison between two groups with qualitative data and **Fisher exact test** was used instead of the Chi-square test when the expected count in any cell found less than 5.

Independent t-test was used in the comparison between two groups with quantitative data and parametric distribution and **Mann-Whitney test** was used in the comparison between two groups with quantitative data and non-parametric distribution.

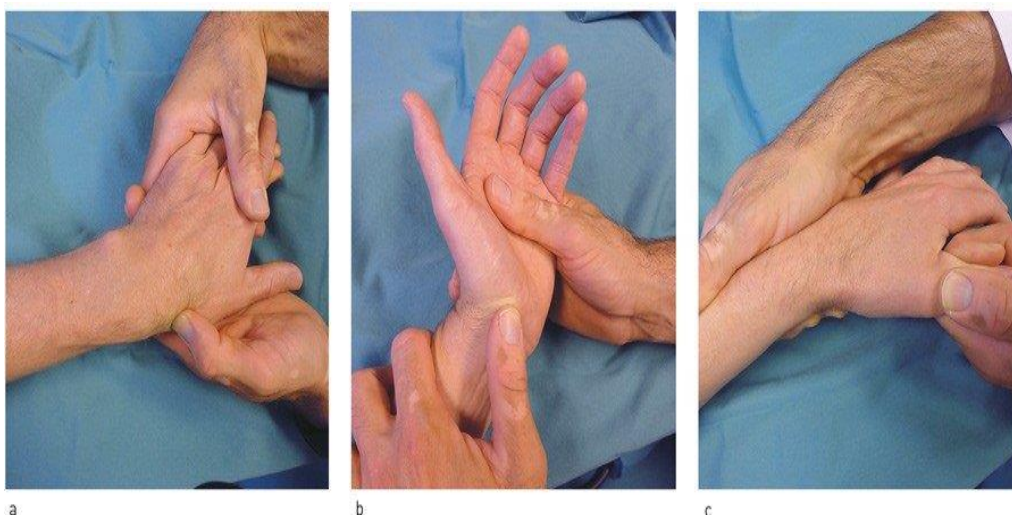


Fig. (1) The three classic clinical tests for scaphoid fracture.(A) Anatomical snuffbox tenderness.

3. Results

A. Clinical (functional) results:

According to mayo modified wrist scoring systems for scaphoid fracture the clinical results were graded as excellent in 12 patients (80%) and good in 3 patients (20%), The results were considered satisfactory as there were no fair or poor results. **Table (1)**

Table (1) Functional end results.

| End result | No | | % | | | |
|------------|-----------|------|----|---|-------|-------|
| | Excellent | Good | 12 | 3 | 80.0% | 20.0% |
| | | | | | | |

Pain, range of movement, return to previous activity and grip strength:

Pain:

By the end of the follow up period 12 patients (80%) had no pain at all, and 3 patients (20%) had mild occasional pain. **Table (2)**

Table (2) Pain intensity.

| Pain | Patients No. | Percentage |
|----------------------|--------------|-------------|
| No pain at all | 12 | 80% |
| Mild occasional pain | 3 | 20% |
| Total | 15 | 100% |

Range of motion:

Twelve patients (80%) regained wrist range of motion with flexion & extension greater than 120 degrees, two patients (13.3%) regained motion between 119 to 110 degree, and one patient (6.7%) regained motion between 90 to 99 degrees. **Table (3)**

Table (3) Range of motion.

| Range of motion(flexion& extension) | Patients No. | Percentage |
|-------------------------------------|--------------|-------------|
| Greater than 120 degrees | 12 | 80% |
| Between 100 to 119 degrees | 2 | 13.3% |
| Between 90 to 99 | 1 | 6.7% |
| Total | 15 | 100% |

Work status:

All patients returned to their pre-fracture work status.

Grip strength:

Thirteen patients (86.7%) have 90% to 100% grip strength compared to the normal side, two (13.3%) patients has 75% to 89% grip strength compared to the normal side **table (4)**

Table (4) Grip strength compared to the normal side.

| grip strength compared to the normal side | Patients NO. | Percentage |
|---|--------------|-------------|
| 90%to100% | 13 | 86.7% |
| 75% to 89% | 2 | 13.3% |
| Total | 15 | 100% |

5)-Smoking:

Comparing the functional end results and smoking, no significant correlation was found. ($P>0.05$ statistically insignificant) **Table (5)**

Table (5) Smoking and the final end result.

| | | Excellent | | End result | | Chi square test | |
|---------|-----|-----------|-------|------------|-------|-----------------|---------|
| | | No | % | No | % | χ^2 | p value |
| Smoking | No | 9 | 75.0% | 1 | 33.3% | 1.875 | 0.171 |
| | Yes | 3 | 25.0% | 2 | 66.7% | | |

6)-Position of the screw

Significant correlation was found between central position of the screw and the functional end results, ($P<0.05$ statistically significant). **Table (6)**

Table (6) Position of the screw and the final end result.

| | | Excellent | | End result Good | | Chi square test | |
|-------------------|-------------|-----------|-------|--------------------|-----|-----------------|---------|
| | | No | % | No | % | x ² | p value |
| Position of screw | Central | 11 | 73.3% | 0 | 0 | 1.875 | 0.0021 |
| | Non central | 1 | 6.7% | 3 | 20% | | |

B-Radiological results:

Radiographic follow up of the patients assessed for union of scaphoid, the relation between the long axis of Herbert screw and the long axis of the scaphoid and fracture line

Fractures of the scaphoid are considered to be united in the presence of trabeculae bridging the defect and increased density at the site of or on each side of the fracture line in plain x ray and CT.

- Time from injury to surgery it range from (1_14 days), mean5.50, STDV 3.51.
- Time of fracture to union range from (6_12 week) mean 7.80, STDV 1.74.
- Time of follow up range from (8_12 month) mean 9.92, STDV 1.92.
- Time of postoperative immobilization range from (2_6 week) mean 2.38, STDV1.20. **Table (7)**

Table (7): Statistical data of study

| | Number of patients | Range | | Mean | STDV |
|--|--------------------|-------|-----|------|------|
| | | Min | Max | | |
| Time from injury to surgery(d) | 15 | 1 | 14 | 5.50 | 3.51 |
| Time to union(w) | 15 | 6 | 12 | 7.80 | 1.74 |
| Follow up time(m) | 15 | 8 | 12 | 9.92 | 1.92 |
| Time of postoperative immobilization (w) | 15 | 2 | 6 | 2.38 | 1.20 |

1)-Sex and Age:

There was no significant correlation between age and time till union, (P>0.05 statistically insignificant) **(Table 8)**

Table (8) Sex and Age and time of union

| | Mean ± SD | Time Of Union | | | | chi square test | |
|-----|-----------|---------------|------|-------|------|-----------------|---------|
| | | <8 | | >8 | | x ² | p value |
| | | No | % | No | % | | |
| Age | | 28.80 | 9.24 | 35.20 | 8.98 | -1.276 | 0.224 |

4)-Smoking:

Significant correlation was found between smoking and time of fracture union, (P<0.05 statistically significant).

Table (9)

Table (9) Smoking and time of union.

| Smoking | | Time Of Union | | | | chi square test | |
|---------|-----|---------------|-------|----|-------|-----------------|---------|
| | | <8 | | >8 | | x ² | p value |
| | | No | % | No | % | | |
| | No | 9 | 90.0% | 1 | 20.0% | 7.350 | 0.007 |
| | Yes | 1 | 10.0% | 4 | 80.0% | | |

Time elapsed before surgery:

No Significant correlation was found between the time of union and time elapsed before surgery, (P>0.05 statistically insignificant) **Table (10)**

Table (10) Time elapsed before surgery and time of union.

| Time elapsed before surgery(days) | Time of union | | | | Independent t test | |
|-----------------------------------|---------------|------|------|------|--------------------|---------|
| | <8 | | >8 | | T | p value |
| | Mean | SD | Mean | SD | | |
| | 4.10 | 2.73 | 6.80 | 4.49 | -5.608 | 0.167 |

Position of the screw.

Significant correlation was found between central position of the screw and the time of union results, (P<0.05 statistically significant). **Table (11)**

Table (11) Position of the screw and time of union.

| Position of screw | | Excellent | | End result Good | | Chi square test | |
|-------------------|-------------|-----------|------|--------------------|-------|-----------------|---------|
| | | No | % | No | % | x ² | p value |
| Position of screw | Central | 9 | 60% | 2 | 13.3% | 1.875 | 0.002 |
| | Non central | 1 | 6.7% | 3 | 20% | | |

Complications:

- Screw protrusion was observed in one case but there was no great effect on the clinical outcome according to MMS score.
- Localized osteopenia as a sign of reflex sympathetic osteodystrophy occurred in one patient with associated fracture distal radius due to immobilization and was responsive to physiotherapy after removal of cast and k-wire.
- Superficial wound infection occurred in one patient, treated by daily dressing and antibiotics for 5 days. There was no effect on the clinical outcome according to MMS score.

There was no nonunion, delayed union or loosening of screw.

Table (12) Complications and their percentage.

| Complication | No. of patients | % |
|-----------------------------------|-----------------|-------|
| Free | 11 | 73.2% |
| Screw protrusion | 1 | 6.7% |
| Reflex sympathetic osteodystrophy | 1 | 6.7% |
| Superficial wound infection | 1 | 6.7% |

Table (13) Relation between complications and end results

| | Excellent | Good | Total |
|-----------------------------------|-----------|----------|-----------|
| Free | 11 | 1 | 12 |
| Screw protrusion | 0 | 1 | 1 |
| Reflex sympathetic osteodystrophy | 0 | 1 | 1 |
| Superficial wound infection | 1 | 0 | 1 |
| Total | 12 | 3 | 15 |

4. Discussion

In a randomised controlled experiment, Adolfsson et al. [13] compared the effects of percutaneous fixation with long-term cast immobilisation. Patients with undisplaced and mildly displaced acute scaphoid fractures (mean age 31 years) were enrolled for the study. There were 25 patients in the fixation group and 28 in the cast group. It took 10 weeks to immobilise the cast group and 3 weeks to immobilise the fixation group, respectively. CT scans were performed to confirm the union of both groups of patients. In the fixation group, ROM was considerably superior ($p=0.02$), but there were no changes in union rate or grip strength.

A lengthy scaphoid cast was compared to percutaneous fixation by Bond et al. [14] Scaphoid fractures in the waist of 25 military members with an average age of 24 years were selected for the study.

There were 11 patients in the fixation group and 14 in the cast group. During the first six weeks, the cast group was kept in a long cast, followed by a short cast, until the union of the fractures was confirmed clinically and radiologically. A brief cast and a detachable splint were used to immobilise the fixation group for 10 days until union. All fractures healed after a period of 25 months of follow-up. The fixation group had significantly shorter times to unionisation (7 vs. 12 weeks, $p = 0.0003$) and shorter times to return

to full duty (8 vs. 15 weeks, $p = 0.0001$) than the control group.

Percutaneous fixation was compared to immobilisation in a Colles' cast with the thumb out of the cast by McQueen et colleagues [15]. In this study, 60 patients with acute undisplaced and mildly displaced scaphoid waist fractures, with a mean age of 27 years, were recruited. After randomization, 30 patients were assigned to each group. Both groups had to be immobilised for at least eight to twelve weeks before they were allowed to begin physiotherapy. For up to 52 weeks, both clinical and radiological examinations were carried out. In the fixation group, the time to union was significantly reduced (9.2 vs. 13.9 weeks, $p<0.001$). Time to return to manual employment (3.8 weeks vs. 11.4 weeks) and participation in sport ($p<0.001$) were similarly significantly reduced in the fixation group (6.4 vs. 15.5 weeks, $p<0.001$). Final follow-up results showed no statistically significant differences in functional outcomes or union rates across groups.

Study by Drac et al [16] found that 38 patients in the percutaneous fixation group and 34 in the cast (control) group had acute, undisplaced, and mildly dislocated waist fractures, respectively. The average age was 27 and the minimum follow-up was 12 months. Not only were there many nonunions in the cast group, but the cast members also had limited range of motion in their hands as well as weak grip

strength ($p < 0.0001$). All patients in the percutaneous fixation group had their union evaluated using a computed tomography (CT) scan, making this method of evaluating union more trustworthy.

In a prospective study, Inoue et al [17] compared 46 minimally displaced and undisplaced acute scaphoid waist fractures treated with percutaneous fixation and 42 fractures treated nonoperatively with a below-elbow cast that included the thumb with 42 fractures treated nonoperatively with percutaneous fixation. The median age was 26.5 years old. Both options were presented to the patients. Ten months was the average follow-up time. Both union rate and return to work were much faster in the percutaneous fixation group than the cast group ($p < 0.001$), according to the researchers. The percutaneous fixation group had all of its fractures healed, whereas the cast group had one nonunion.

According to Majeed's research, [18] cast therapy has the drawbacks of a longer immobilisation period, joint stiffness, lower grip strength, and a longer recovery period before manual activity can be resumed. An early return to manual labour and mobility is possible with percutaneous fixation, which minimises harm to blood flow and soft tissues. Evidence shows that percutaneous screw fixation permits a quicker time to union by 7 weeks and an earlier return to manual labour by 8 weeks, with identical union rates, while cast therapy is more time-consuming.

Two studies found no statistically significant differences in clinical outcomes, union times, or gripping and pinching strength between patients treated with the dorsal technique versus the volar method. The volar approach was used to treat all of the patients in this research. Utilizing a dorsal approach, Wozasek and Moser (21) presented 25 instances of delayed union and 8 cases of established nonunion that were successfully treated using a percutaneous dorsal approach. After a mean of 82 months, 81.8 percent of the bone healed. Because a bone transplant is necessary, the present authors agree with others that an open approach should be used for the treatment of delayed fractures.

Our study's functional and radiological outcomes.

The average age of the patients in our research was 30.93 years, with 12 males and three women participating in the study. All patients were categorised as B2 using Herbert's categorization system (complete waist fracture).

The modified Mayo scoring system was used to evaluate these instances. Following are the clinical outcomes, which were rated excellent and good. Good or excellent results were seen in just three of the 12 individuals (about 20%). (20 percent).

It was judged acceptable since there were no fair or bad outcomes.

Unions take an average of 7.80 (range, 6-12) Weeks to form. Patients returned to work in 14 to 45 days, depending on their employment, and returned to

active sports in six to 16 weeks, depending on the severity of their injuries.

Among the 30 fractures studied by Iacobellis et al. [22] in their research, there were 30 outstanding outcomes, three good, two fair, and one bad results based on the modified Mayo wrist score. There was a wide range of return to work and active sports in the range of 18-40 days depending on the patient's employment and 57 days on average for radiographic union of all fractures (range 35-70 days).

There were satisfactory functional outcomes in all instances in Al-Ashhab and Elbegawi [23]. After a mean of 57 days (ranging from 35 to 70 days), the fracture healed in all instances, and the return to work and active sports varied from 18 to 40 days depending on the patient's employment.

As measured by the modified Mayo wrist score, there were four "good" and 37 "excellent" outcomes in the research by Verstreken and Meermans [24]. Patients were able to return to sedentary work within four days and to manual labour within six weeks after the procedure.

Luengo et al. conducted a research at Luengo [25]. In all but one instance, the fracture healed after a mean follow-up period of 6.6 weeks (ranging from 5 to 11). During the first two weeks of treatment, all patients were able to carry out their normal routines, although they were careful not to engage in any strong activities or use their hands unrestrictedly until the fifth week.

In our research, 12 patients (80%) had no pain at all at the conclusion of the follow-up period; 3 patients (20%) experienced minor occasional discomfort. There were 12 patients (80%), two patients (13%) who restored flexion and extension mobility higher than 120 degrees, one patient (7%), and one patient (8%) who regained motion between 90 and 99 degrees.

All patients were able to return to their pre-fracture jobs.

As compared to the normal side, 13 patients (87%) have grip strength of 90 percent to 100 percent, whereas 2 (5 percent) patients have grip strength of 75 percent to 89 percent.

In Al-Ashhab and Elbegawi's research Al-Ashhab et al [23], all patients attained full flexion, extension, and ulnar deviation at 6 weeks, and radial deviation was equivalent to the contralateral side after 3 months in 12 patients and 4 months in 3 patients after 4 months. At 6 weeks, the mean power grip was 90% of the contralateral hand, and at 3 months, it was 98%.

Average range of movement was determined to be 65 degrees in extension and 75 degrees in flexion (range 58-75 and 72-80, respectively) in the research by Luengo et al [25], and gripping power could not be separated from that of the opposite hand.

There was a significant difference in grip strength between the damaged and uninjured sides in Verstreken's research, with the injured side's grip strength being 55.7 kg (SEM) and the uninjured side's grip strength being 52 kg (SEM).

Using the volar technique, we were able to locate the bone landmarks, maintain the reduction throughout the treatment, and interpret the fluoroscopic picture with ease.

Using a dorsal technique was not desirable in this research since there were no occurrences of type B3 fractures, which is the primary justification for a dorsal approach.

It is most common among young men who wish to use their hands early, such students preparing for examinations or patients avoiding long-term immobilisation because of the financial consequences.

An single scaphoid fracture was treated with two weeks of immobilisation, which allowed the patient to return to work sooner and there were no complications linked to soft tissue stripping at a minimum of six months.

There was a statistically significant association between age and the time of union, but there was no correlation between age and union time. Most studies did not highlight that age had a significant impact on the findings.

An associated lower end radius fracture was observed to have a strong link with the ultimate outcome, and two patients with an associated lower end radius fracture in our research had excellent outcomes.

The findings of this research also reveal that smoking affects the period of union, with nonsmokers showing faster healing than smokers. Smoking cessation education is critical for patients.

This research demonstrated a strong link between the screw's central location and both good functional outcomes and a quick union. It was shown that central insertion of the screw in the proximal scaphoid fragment with either cannulated or Herbert screw has great outcomes and affects the time it takes for the scaphoid to unite (see to studies 22-24 & 23).

According to Chan and colleagues [27], the biomechanical analysis of the human cadaveric model indicated that the central location of a screw was better to that achieved by placing the screw eccentrically.

According to our findings, diabetes and the interval between onset of diabetes and surgery had no statistically significant impact.

There is debate about whether or not to penetrate via the trapezium while placing the volar screw. Data show that the transtrapezium technique successfully accomplishes central placement of a screw in the proximal and distal poles of a scaphoid waist fracture model. When opposed to central implantation in merely the distal pole, this location provides a biomechanical benefit. However, the scaphotrapezium joint may be damaged by this method, thus an alternative entrance site is desirable. In order to preserve the scaphotrapezium joint, we did not use the transtrapezium technique in this investigation.

In addition, there is disagreement on the kind of screw should be used for fixing. From Herbert screws to headless compression screw to 3.5-mm cannulated

screw Acutrak, these many types of screws have been utilised for decades.

Cannulated Herbert screws were the implant of choice in our investigation. Shaw, [28] and Rankin et al [29] demonstrated that the cannulated screw had stronger compression forces, but recognised the benefits of the headless Herbert screw, which can be buried inside the scaphoid without altering its bone architecture, for biological reasons. Compression was better with the Herbert screw, according to Newport et al [30].

For inter-fragmentary compression, the Acutrak screw is a headless, self-tapping, and fully threaded device. The Acutrak screw, on the other hand, is headless, has a variable pitch, and provides better inter-fragmentary compression than the Herbert screw.

A comparison of the compressive effects of the Herbert screw and the Acutrak screw by Adla et al (31) revealed no discernible differences. Regardless of the kind of screw used to correct the fracture, central screw placement has been shown to be the most important factor in ensuring proper fixation and compression of the fracture site.

A recent research by Bedi et al. [32] recommends subtracting 4 mm from the measured length of the screw to get the correct screw length.

One incidence of screw protrusion was found in this investigation, however it had no significant impact on the clinical result as measured by the MMS score. One patient with an accompanying fracture of the distal radius had localised osteopenia as a symptom of reflex sympathetic osteodystrophy, which responded to physiotherapy when the cast and k-wire were removed. One patient developed a superficial skin infection, which was successfully treated with a daily bandage and medication in only five days. Non-union, delayed-union, and screw loosening were not present.

Since Verstreken and Meermans [24], there was osteoarthritis of the scaphotrapezium joint and complicated regional pain syndrome, [22], nonunion and screw protrusion, [13], nonunion and reflex sympathetic dystrophy, (32), nonunion, and delayed union, respectively.

5. Conclusion

To decrease the time to bone union, percutaneous screw fixation may be used for marginally or non-displaced scaphoid waists. This allows for a sooner return to sports or work with less mobility, grip strength and muscle atrophy associated with cast immobilisation. With the volar approach, it is simple to accomplish and sustain a reduction, as well as to identify the bone landmarks and to interpret the fluoroscopically produced pictures more easily.

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