

## ORIGINAL ARTICLE

# Effectiveness of Belfast Regime on Flexion Tendon Injury Zone V Using Tam Scoring

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## ABSTRACT

**Objective:** The aim of the study is to evaluate the effectiveness of belfast protocol in Flexion tendon injury of zone v through TAM scoring.

**Methodology:** A prospective study will be directed to find out the outcome of Belfast protocol in flexor tendon injury in the premises of plastic surgery ward civil hospital Karachi, we were use non probability sampling technique to enlist the patient .we were systematized a well-designed questionnaire and through TAM scoring to measure the intervention outcome in term of functional ADL.

**Results:** The results showed that there were 76% male and 24% female patients were affected. Most of the injury happened at work in 29% and at home 21% patients.44% patients were (21-30 ) years of age , 36% patients were (31-40) 4% of patients were (41-50) , 2% of patients were (51-60). TAM Score was observed that total 22 patients had excellent outcome (Score 100), 19 patients had good outcome (Score 75-99), 4 patients had fair outcome (score50-74 ) and only 5 patients had poor outcome. It was observed that treatment was effective in 45 patients because their TAM Score was >50 and in only 5 patients the treatment was ineffective because their TAM Score was <50.

**Conclusion:** We concluded that belfast regime (early passive and active range of motion of fingers the rate of tendon adhesion and rupture rate was very low and gave good result , most commonly men was affected with the injury that's 76% and commonly injury happened at work place by accident . There is no standard protocol and therapist must communicate with the surgeon and patients before selecting an appropriate therapy program..

**Keywords :** Rehabilitation ,Flexor injury , Zone V, Early mobilization ,Belfast technique.

## INTRODUCTION

Hand is one of the most common presenting injuries seen in emergency department compromising about 20% of all injuries<sup>1</sup> and requires surgical repair<sup>2</sup>. The mechanism of injury commonly involve was through sharp objects<sup>3</sup> like knife, glass, and blade in cases of attempting of suicide causing the site of wrist vulnerable for injury.

Hand is comprised of 5 zones, described by Kleniart and verdant<sup>1</sup> each zone has its own unique integrity and different surgical and rehabilitation approaches and one of the most explored subject<sup>2</sup> . Most frequently seen injuries in Pakistan ,is of zone 5 which is the junction between the transverse distal crease on wrist and the forearm muscles<sup>4</sup>. The repair of this area is difficult because this type of trauma result in tendon ,median, ulnar nerve and arteries abrasion<sup>4</sup> and it is called as spaghetti wrist because of the all thea structure tightly packed in a sheet passing through the carpal tunnel as according to Clifton et al ,the exposed wrist laceration seems like a spaghetti spread on a red tomato puree<sup>5</sup>

There is a delicate balance between the extensor and flexor muscles inadequate approach can result in adhesion formation, swelling and can have high risk of functional disability of hand. In recent years lot of work have been done in managing of flexor tendon injuries by improving surgical technique and finding out the best operative procedure that is both easily understandable and approachable and planning of perfect rehabilitation program<sup>6</sup> .

In the early 90s the repair of flexor tendon injury was treated secondary but it shows that primary repair give good outcome ,but result of surgically repaired hand mostly depend upon the skills and knowledge of the hand therapist<sup>7</sup> and timing of referring the patient to therapist . Post-operatively there are number of regime to treat hand injury but proper early mobilization key to avoid adhesion formation,swelling and delay healing because repeatedly surgical intervention will not only weaken the tendon and result in poor outcome so selection of appropriate regime plus a good and strong suture technique ,and a quality relation and understanding

is important between the surgeon and the hand therapist<sup>4</sup> can spare the risk of hand's function disability .

The aim of our study was to find the outcome of rehabilitation of flexor tendon injury of zone v using Belfast regime so a standardized protocol can be followed with the maximum benefit to the patients

## MATERIAL AND METHOD

This prospective study of 50 participants, both male and female, from age 15 to 60 years, was taken. All those who fulfilled the inclusion criteria only flexor injury zone v of hand with sharp object were taken because most common injuries were seen in emergency. Severe joint injury, skin loss requiring coverage (Degloving injury) , any fracture of forearm or hand, tendon transfer and flap or graft procedure were excluded from study.

Only cut from sharp object like glass, mirror, knife was considered because rest of the object might cause fracture or loss of skin coverage for which k-wiring, grafting or flap would be required and the exercise regime would be change in those criteria. Tendon were repaired with modified 2 strand kessler's technique using 4-0 propylene). Strong suture bond was the requirement for the early rehabilitation program, so that the tendon gliding is possible and formation of adhesion must be avoided.

After the surgery, the hand is positioned in the slab and POP cast is molded on the hand .then patient was referred to the Hand Therapist for managing the functional outcome. Patients were made to stay in hospital for 2 post operative days for checking of suture sites changing into light dressing. Patient's rehabilitation starts from 1st post-operative day with regime of modified Belfast protocol. A dorsal splint was placed on the hand which had 30 degree of wrist flexion while rest of the interphalangeal joint remain in neutral position that is zero degree of flexion. Passive flexion with active extension of finger were advised for 2 weeks and to keep the hand in elevated position to prevent edema from forming. To differentiate between the glide of FDP and FDS isolated flexion of distal interphalangeal joint and proximal interphalangeal joint was done passively. After 2 week patients were given respected

date for follow up, Sutures were removed after 15 days until then patients were advised to change their dressing regularly. After 2 weeks same protocol was followed along with wrist flexion and passively flexing the finger with hold /relax protocol for every 2 hours 10 repetitions .and holding for 10 seconds .these exercise were followed after removing of splint and placing it back after,

All exercise was taught by the therapist and was included as home exercise program. At 4th week splint was removed and active movement were set in motion, night splint were continued. At 5th week patients were allowed to use their hand in performing ADLs, like taking care of hygiene ,dressing and feeding but carrying any amount of weights were forbidden. On start of 6th week graded level of resistance exercise were started and was part of rehabilitation till 8th week. From 8-12th week focus was kept on relearning of fine motor skills, At the start of 12th week patients were allowed to join back their jobs. In case of nerve injury sensory re-education was included along with muscle stimulation other therapies like ultrasound hydrotherapy were also used according to the condition. Patients were kept on follow up once in a week to keep a check on prognosis of the outcome and more attention was give to teach patients how to manage wound and perform exercises at home for their ease. For peripheral injuries patient was kept on follow up for 6 months to document the recovery.

The range of motion of fingers and wrist were documented every week on follow up but the main assessment of the Belfast regime was done on the last reading before patient resuming his activity at work.

## RESULT

The results showed that there were 76% male and 24% female patients with mean age was  $29.9 \pm 7.46$  years. Most of the injury happened at work in 29(58%) and at home 21(42%) patients. According to data most injuries were caused by glass in 41 patients, knife 6 machinery in 1 and others caused in 2 patients respectively.

The Descriptive statistics of pre and post Assessment TAM Score is presented in Table-2. Mean pre operative TAM score was  $8.1 \pm 25.0$  while postoperative TAM score  $84.65 \pm 24.8$ .

The outcome of the treatment was also assessed according to grade i.e. poor, fair good, and excellent. It was observed that post treatment total 22(44%) patients had excellent outcome (Score 100), 19(38%) patients had good outcome (Score 75-99), 4(8%) patients had fair outcome (score 50-74 ) and 5(10%) patients had poor outcome (Score < 50).

Table 2: Descriptive Statistics of TAM Score

| assessment                | Mean $\pm$ SD    | 95%CI        | Median (IQR) | Min - Max | Range |
|---------------------------|------------------|--------------|--------------|-----------|-------|
| Pre assessment TAM Score  | $8.1 \pm 25.0$   | 0.981-15.21  | 0(0)         | 0-100     | 100   |
| Post assessment TAM Score | $84.65 \pm 24.8$ | 77.5 – 91.71 | 92.4 (19.83) | 0-100     | 100   |

Table 3: Paired sample t-test Mean difference of tam score (N=50)

| Table 3: Paired sample t-test mean difference in tam score (N=50) |                   |      |        |     |         |
|---|-------------------|------|--------|-----|---------|
|   | Paired Difference |      | t      | d f | p-value |
|   | Mean              | SD   |        |     |         |
| According to Pre and Post Treatment                               |                   |      |        |     |         |
| Pair pre & post TAM Score   | -81.46            | 24.0 | -24.0  | 49  | 0.000   |
| According to Outcome Categories                                   |                   |      |        |     |         |
| • Excellent (Score 100) N=22                                      | -77.5             | 35.5 | -10.23 | 21  | 0.000   |
| • Good (Score 75-99) N=19   | -84.7             | 6.10 | -60.5  | 18  | 0.000   |
| • Fair (score 50-75) N=4  | 65.2              | 8.38 | -15.5  | 3   | 0.001   |
| • Poor (score<50) N=5   | -18.3             | 19.5 | -2.095 | 4   | 0.104   |

Paired sample t-test was applied. P-value  $\leq 0.05$  considered as significant.

## DISCUSSION

Active part of the upper extremity is hand. Hand skill in various professional, psychological and social activities exposes him to many risks, professionally and socially<sup>8</sup>.

Flexor tendon injury is very difficult to evaluate one because of the fact that the result of the treatment depend upon many things like dominancy of hand , nerve injuries , vascular damage ,surgical techniques ,culture difference , patients understanding of

The effectiveness of the treatment was also analyzed i.e. effective and ineffective. It was observed that treatment was effective in 45 patients because their TAM Score was  $>50$  and in only 5 patients the treatment was ineffective because their TAM Score was  $<50$ .

The significance of the treatment was evaluated according to mean difference of pre and post TAM Score by applying paired sample t-test and p-value  $\leq 0.05$  was considered as significant. It was observed that the mean difference of TAM score between pre and post treatment was significant with  $p < 0.01$ . The results are presented in Table-2

The significance of the outcome was also evaluated according to outcome categories and the mean difference of pre and post treatment TAM Score was assessed applying paired sample t-test and p-value  $\leq 0.05$  was considered as significant. It was observed that in each outcome category i.e. excellent, good, fair and poor, the mean difference of TAM score between pre and post treatment is significant with  $p < 0.01$ . The results are presented in Table-3.

Table 1: Patient's Characteristic (n=50)

| Variable   | Patients | Percentage |
|--|----------|------------|
| Age in years (Means Age $29.9 \pm 7.46$ years)         |          |            |
| • < 18   | 8        | 16%        |
| • 18 – 20  | 6        | 12%        |
| • 21 – 30  | 17       | 34%        |
| • 31 - 40  | 13       | 26%        |
| • 41 – 50  | 4        | 8%         |
| • 51 - 60  | 2        | 4%         |
| Gender   |          |            |
| • Male   | 38       | 76         |
| • Female   | 12       | 24         |
| Frequency Distribution of where it happened            |          |            |
| • Work   | 29       | 58%        |
| • Home   | 21       | 42%        |
| Frequency Distribution of how it caused                |          |            |
| • Accident   | 44       | 88%        |
| • Suicide  | 6        | 12         |
| Frequency Distribution of Post Treatment Outcome       |          |            |
| • Excellent  | 22       | 44%        |
| • Good   | 19       | 38%        |
| • Fair   | 4        | 8%         |
| • Poor   | 5        | 10%        |
| Frequency Distribution of Post Treatment Effectiveness |          |            |
| • Effective  | 45       | 90%        |
| • Ineffective  | 5        | 10%        |

rehabilitation protocols last but not least the chances of human error<sup>9</sup> . In Pakistan most commonly zone v injuries is seen due to hand held labor using Belfast regime was the only reason because its more understandable to patients and can be followed easily as home exercise program<sup>10</sup>. Most of the hand injuries involved nerve involvements and the main goal of the treatment is to make patients functionally independent so they are evaluated atleast for

6 months because in 6 months the patient is able to achieve range of motion and able to ADLS.

Our study observed that female to male ratio was 1:3.16. The higher rate of hand injuries in men is clearly linked to men's lifestyle. Men participate more in outdoor activities. However, in the research of Mohammad Shiraz Raza, it was reported that nine patients were female while 22 were male, with a male to female ratio of 2.4:1<sup>11</sup>. The age ranged from 15 to 60 years with mean age 29.9±7.46 years. The Flexor Zone 5 injuries were most common in the 3<sup>rd</sup> and 4<sup>th</sup> decade in our study. The other series also show higher incidence of this injuries in 3<sup>rd</sup> decade age groups. However study of Muhammad Shafiq showed Twenty four (80%) patients were between 21 to 40 years<sup>12</sup>. The present study showed the most common mechanism of zone V flexion tendon injury were accident in 44(88%) and suicide in 6(12%) cases. However the international study of reported injury was accidental, in 3 (10%) homicidal and in 3 (10%) injury was suicidal<sup>11</sup>.

The goal of treatment is to provide an acceptable functional and cosmetic upper extremity with a normal range of motion. The modified Belfast protocol applied in the assessment of functional and normal range of motion. Post Treatment Outcome result of flexion tendon injury zone v using tam scoring were good. According to TAM scoring, the final outcome of treatment in the present study achieved excellent results were observed in 44% patients, good 38% patients, fair 4% patients and poor 10% patients, which is comparable with the results of Seyed Abdolhossein Mehdi Nasab<sup>10</sup>, who reported 92 patients had excellent results (54.36%), 37 cases had good results (22.63%), 14 patients had fair results (7.68%) and 28 patients had poor results (15.33%)<sup>14</sup>.

**Limitation of the Study:** Limitation of the study is that's it's a prospective nature of study, the treatment of traumatic tendon injuries were only observed in a government setup where there were limited sources and benefits to patients. Maybe in future further study can be done in both private and government setup to evaluate the effectiveness of the Belfast regime and apart from TAM scoring other evaluation questionnaire can be used for examining others factors that's include DASH or MULLIGAN questionnaire. but was not used in this study due to shortage of time.

Other than that patient should be evaluated for at least 12 months to evaluate the strength for hand held dynamometer can be used but mechanical can give error reading. 19.

## CONCLUSION

We concluded that Belfast regime (early passive and active range of motion of fingers) the rate of tendon adhesion and rupture rate was very low and gave good result. Most commonly men were affected with the injury that's 76% and commonly injury happened at work place by accident. Since the injury was commonly showed in age between 20 to 40 years of age and showed good prognosis. There is no standard protocol and therapist must communicate

with the surgeon and patients before selecting an appropriate therapy program.

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