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ORIGINAL STUDY

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Are running stitches needed in DT4 Single Anteromedial Bundle Biological Augmentation transplant preparation ?

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Partial running whipstitches are commonly used in DT4 SAMBBA (Single Anteromedial Bundle Biological Augmentation) transplant preparation. We wanted to determine whether or not running whipstitches all over the graft affected the risk of iterative rupture and the overall outcome of the procedure. Two groups of 32 patients comparable in terms of sex, age, sport level and type of sport practiced were recruited in this prospective cohort study. DT4 SAMBBA was performed for all patients by a single surgeon. One cohort was treated with a full length running whipstitches during SAMBBA DT4 transplant preparation (F), the other had a classical SAMBBA DT4 graft preparation (NO F). The ACL RSI, subjective IKDC and KOOS scores were established preoperatively and with a 4 years follow-up. Complication rates (iterative rupture, cyclops syndrome) as well as pre and postoperative score variations were calculated.

No statistically significant difference in terms of frequency of iterative rupture or complications could be demonstrated (NO F 9.3% vs F 3.1%, p = 0.61). There was no difference either on score variations compared pre and post operatively. Full running whipstitches of the DT4 SAMBBA transplant does not seem to influence the ligamentoplasty outcomes with a 4 years follow-up.

Keywords: DT4 SAMBBA; ACL transplant; running stitches; iterative rupture; scores.

INTRODUCTION

One of the main factors in ACL ligamentoplasty failure is the repeat ACL injury. In addition to revision surgery that it requires with its set of complications, it is very badly experienced by athlete whose expectations are increasingly demanding, even in the amateur world. Bone tunnels placement, graft harvesting site and even the exact nature of its composition are all elements that have already been subjects of studies designed to isolate the best compromise in terms of risk of postoperative rupture.

This study sought to demonstrate whether there was an advantage to make a full running whipstitches

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during SAMBBA (Single Anteromedial Bundle Biological Augmentation) *(1)* DT4 transplant preparation, with a 4 years follow-up, in terms of iterative rupture rate or cyclops occurrence, but also in terms of results in main pre- and post-operative knee functional scores.

Our work therefore focused on one of the ligamentoplasty techniques using hamstring, a harvesting site that is now frequently used for this type of surgery but for which many variants exist in terms of transplant preparation methods *(2)*.

Partially suturing the autograft has several advantages : facilitate the handling of the transplant during the different operative phases, but also and above all optimize the tendon's capacity to resist the traction forces required for its preparation, which it will then have to undergo during implantation and in the first few months following surgery *(2,3)*.

There are many variants regarding suturing graft techniques during its preparation, concerning number, type of sutures or stitches, and which ultimately affect biomechanical transplant properties *(4)*.

It is therefore intuitively and on the basis of the literature *(4,5)* that we wished to verify whether completely stitch the DT4 transplant during a SAMBBA ligamentoplasty could positively influence the iterative rupture rate and the surgery functional results.

MATERIAL AND METHODS

This prospective single center cohort study was conducted with a 4 years follow-up between June 2016 and July 2020. All subjects had their ACL surgery between June and December 2016, done by a single surgeon. Subjects were recruited by the operator after a medical consultation. Pre operative functional scores (IKDC subjective, KOOS, ACL-RSI) were filled no more than seven days before surgery and same post operative scores were filled between June and July 2020. Complications (iterative transplant rupture and / or cyclops syndrome) rates were assessed in July 2020. The institutional ethical review board had to obtain approval. Patients must give their consent before their inclusion in the study.

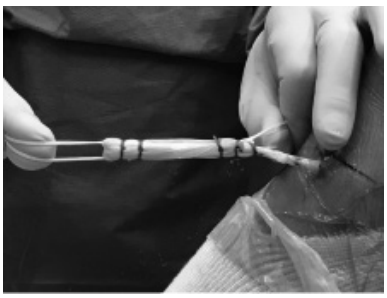

Figure 1. — Classic SAMBBA DT4 graft preparation made for "NO F" group.

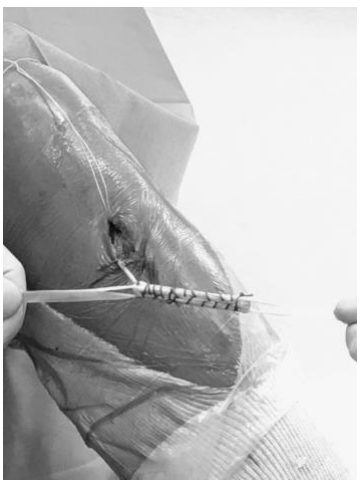

Figure 2. — Full running whipstitches SAMBBA DT4 graft preparation made for "F" group.

A standardized case report form was employed to collect patient data.

Inclusion criteria were : adult athletes, complete ACL rupture confirmed on MRI, primary surgery of DT4 ACL. Exclusion criteria were : patients under the age of 18, revision ligament surgery. Between June and August 2016, 32 patients were recruited and had a primary SAMBBA DT4 classic surgery (NO F group). From September to December 2016, 32 patients comparable in terms of age, gender, type and level of sports had a primary SAMBBA DT4 surgery with a full running stitches transplant (F group).

Sutures as shown on pictures was done with a Mersuture 3 ® (Figures 1 and 2).

Main characteristics of the two cohorts are shown in Tables I, II and III.

A Student t-test was conducted to compare the proportion of failure or complications in "F" and

Table I. — Comparison of the two cohorts by age (years) and sex (SD : standard deviation)

	F	NO F	P value
Age : mean (SD)	32.9 (8.6)	34 (8.5)	0.61
Men / Women	23 / 9	24 / 8	1

Table II. — Percentage of different types of sport (%) in F and NO F cohorts

	F	NO F	P value
Soccer %	31.25	31.25	
Running %	12.5	25	
Rugby %	9.3	6.2	
Basketball %	6.2	6.2	
Tennis %	6.2	3.1	
Gym %	6.2	3.1	
Biking %	6.2	0	
Boxing %	6.2	0	
Badminton %	0	6.2	0.57
Ski %	0	6.2	
Swimming %	0	3.1	
Handball %	3.1	3.1	
Martial arts %	3.1	3.1	
Athletics %	0	3.1	
Dance %	3.1	0	
Motorbiking %	3.1	0	
Field hockey %	3.1	0	

Table III. — Percentage of different sports levels (%) in F and NO F cohorts

	F	NO F	P value
Amateur %	56.25	53.1	
Regional %	34.3	37.5	0.965
National %	9.3	9.3	

"NO F" groups. The same test was performed to compare pre and post operative scores in the two cohorts.

RESULTS

There was no significant difference in terms of complications rates between the two groups (NO F = 9.37 %, F = 3.12 %, p= 0.61) (Table IV).

On a functional point of view, we did not show any difference in pre-post operative scores variations with a 4 years follow up, whether the patient had a fully sutured transplant or not (Table V).

Table IV. — Complications rates with a 4 years follow up

	F	NO F	P value
Transplant iterative rupture (%)	3.12	3.12	1
Cyclops syndrome (%)	0	6.25	0.182
Total complications (%)	3.12	9.37	0.61

DISCUSSION

There are a number of articles in the literature that discuss transplant preparation techniques with a perspective of determining which one will contribute the most to a successful transplant evolution.

Tiefenboeck and Boniello demonstrate that increasing the diameter of the suture and/or graft increases its resistance capacity *(4,5)*. However, these are laboratory studies, with axial tension forces applied to the graft, which do not represent graft physiological conditions of use, which is regularly exposed to compressive or shear forces. From this point of view, our study confirmed Tiefenboeck's moderation *(4)* regarding transposition of ex vivo results in "real life", since in our work increasing transplant diameter by full suturing had no obvious clinical repercussions with a 4 years follow up.

Another discrepancy between experimental and clinical results is revealed by our study : there is no more cyclops syndrome in "running whipstitches" group, despite the hypothesis raised by Tiefenboeck when he described a potential increased risk of irritation if more sutures are used near the joint *(3)*.

However, this lack of difference between grafts sutured integrally or not, clinically corroborates the in vitro conclusions of Hong et al. study when they found no difference in terms of breaking load

Table V. — Pre-post operative functional scores variations with a 4 years follow up

	F	NO F	P value
ACL RSI	34.61 (32.6)	37.63 (33.7)	0.72
IKDC SUBJECTIVE	31.62 (21.7)	32.39 (27.6)	0.9
KOOS SYMPTOMS AND STIFNESS	28.91 (24.9)	31.84 (28.6)	0.66
KOOS PAIN	21.95 (23.1)	29.3 (22.5)	0.2
KOOS DAILY LIVING	19 (22.7)	26.96 (23.7)	0.18
KOOS SPORTS	42.96 (33.4)	48.94 (34.8)	0.49
KOOS QUALITY OF LIFE	50.48 (30.7)	40.62 (33.1)	0.22

whether the graft is sutured by 3, 5 or 7 knots, and this according to three different types of knots *(6)*.

Therefore, there does not seem to be any clinical interest to prepare the DT4 SAMBBA graft with a full suture. This is all the more beneficial to patient as well as to surgeon because, as Wittstein mentions in one of his articles *(7)*, suturing the transplant is time-consuming and exposes surgeons to needles.

LIMITATIONS

Main limitations of our study are described as follow : this work relates the experience of a single surgeon with his own suturing technique, and thus raises the question of the reproducibility of it. Running whipstitches or not is obviously not the only risk factor for the failure of a SAMBBA DT4 procedure. However there was at this time no study which focused on this part of transplant preparation. There were many types of sports and levels of participation, but no difference between the two groups. The subjective nature of functional surveys as secondary evaluation criteria can be discussed; however the main judgment criterion (breakup rate) was objective. At last, a 4 years follow up is interesting but a bit limited.

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