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Strength Training for Rugby Union: The General Preparation Phase

ABSTRACT

The purpose of this paper is to address pre-season training in rugby union, with the focus on weight training in the general preparation phase.

The issues addressed include the manipulation of several key variables including frequency, intensity, volume and periodisation in relation to the effectiveness of achieving specific training outcomes in the strength program.

The goal is to optimise athletic performance while reducing risk of injury.

The article addresses the conventional approach to periodisation to solve program goals sequentially, encompassing 3 mesocycles including hypertrophy, strength and power. The periodised plan is the most effective way to vary training stimulus and is an essential component of our training plan.

Effective strength programs not only achieve physical performance benefits, but also contribute to reducing the risk of injury.

The strength and conditioning coach needs to be aware of time constraints on their athletes and aim to ensure our programs are time efficient and practical whilst still achieving our program objectives.

Introduction

In my 10 years as a strength and conditioning coach specializing in athletic conditioning for rugby union I have seen the rapid development of new training methods to enhance sport performance. While the terminology may have changed; the cornerstone of athletic development has not, in that strength training during the general preparation phase remains an integral component in athletic conditioning for sport. The general preparation phase in relation to this article incorporates hypertrophy, strength and power development and will begin early October and is completed by the end of February before the competitive season begins. As strength and conditioning coaches we should all be committed to adapting training techniques to be as sports specific as possible, with the ultimate goal of optimizing athletic performance while reducing the risk of injury. It is the purpose of this article to address pre-season conditioning, with the focus on strength training during the general preparation phase. Weight training is an essential component of pre-season conditioning that will increase structural stability and mobility, reduce the risk for injury and enhance an athlete's strength expression and power projection. This in turn may allow players to optimise and to utilise their skills, for the purpose of executing team and individual tactics.

Strength Requirements

Rugby union is a contact team sport that requires a variety of physiological requirements due to the high intensity nature of the sport, which involves short repeated sprints to high degrees of strength expression through high frequency contact. (Reilly 1997) outlines that heavy body contact can result from one on one tackling, scrums (scrimmaging), rucks and mauls, as well as attacking

runs. During a game an athlete's body is placed under considerable stress and at times, compromising positions. Recent data presented by Gabbett (2000) indicates that significantly more injuries occur in the second half of matches than in the first half (70.8% V 29.2%, $\chi^2=162.29$, $df=1$, $p<0.001$). When injuries at the beginning and end of the season were compared (by dividing each season in half) more injuries occurred in the second half of the season ($\chi^2 = 22.94$, $df=1$, $p<0.001$).

The author concludes that fatigue, microtrauma or both, may contribute to injuries. Furthermore, fatigue may lead to greater risk of injury to the neck and head (NH&MRC 1994). Therefore, improved structural stability and mobility in conjunction with improved conditioning may assist in the reduction of injuries.

The science of examining rugby and its participants has developed rapidly to meet the increased demand for knowledge on the requirements of the game and characteristics of the players (Nicholas 1997). Rugby union players have a diverse range of physical attributes, and a distinct physique will naturally orient a player toward a particular position over others (Quarrie, Hancock, Toomey & Waller 1996). The front row position demands strength and power in the scrums. The second rowers have a large body mass and added power is a distinct advantage. The loose forwards require strength and power as their position requires them to defend as well as retain and turn over possession. Strength is essential for the half back as he is constantly in amongst his own and opposition forwards in physical situations and must have good acceleration. The inside backs require strength speed and power because of the high intensity of contact with the opposition in defense and attack, whereas outside back require speed and power in attacking situations and cover defending (Duthie, Pyne & Hooper 2003).

Body mass in rugby union of elite players has increased significantly over the past three decades. The rate of increase in body mass of elite rugby union players of 2.6kg per decade was well above those of the general population of young males (Olds 2001). Therefore, as the elite level athletes increase in body mass, speed and power, it would be fair to assume that the natural progression is for club grade players to improve at a comparable rate. It is vital that each level of rugby (school boys through to National) improve their approach in strength, power and all aspects of conditioning to allow players an acceptable base to step up to the next level. It has been stated in (Baker 2002) in a study of rugby league players, ranging from junior high school level to National level, that as the athlete becomes bigger and stronger with age and training experience, they also become stronger per kg of body mass. The trained junior high school, senior high school, college and National rugby league players are capable of lifting 102, 115, 124 and 148% of their body mass respectively, in the 1RM bench press. There is limited statistics on rugby union at present, but given the fact that both codes in Australia follow similar school age progressions and our National teams are both professional codes and ranked in the top 3 in the world, it is a comparison that can be utilised. In a study by (Gabbett 2002) of vertical jump heights in rugby league players, there is significant increases in strength and power of athletes from U19 to 1st grade level. His results of vertical jump heights for backs was 40.0, 42.9 and 50.9cm for U19, 2nd grade and 1st grade respectively. Similar progressions in forwards of 37.9, 41.0 and 48.7cm respectively was recorded. Strength training has been repeatedly shown (Kraemer 1997) to increase levels of fat-free mass, strength

expression and power projection, underlying the importance of such a training modality for athletes.

Program Design

It is well accepted that in order to maximize the benefits of resistance training, periodisation is superior to other training methods for the development of strength and power sports (Fleck 1999), thus a rugby specific periodised program will be presented, and will be the basis of this paper.

As demonstrated in (Willoughby 1993) football players on a periodised training program achieve superior results to constant set/rep multiple set programs. In addition other studies (Stone et al 1979) as well as (Stowers et al 1984) utilising periodised training methods have also demonstrated superior results when compared to lower volume protocols. It has also been demonstrated in (Kraemer, 1997) that short and long term adaptations in strength, power and muscle endurance are greater with a periodised multiple set training program.

The basic guidelines for the resistance training of athletes (NSCA Position Stand) states that resistance programs for athletic performance should be periodised in order to optimise the adaptations over long term training and also help reduce the potential to overtrain. It is also stated that multiple set periodised resistance training programs are superior to single set, non periodised programs for physical development.

A general typical preparation phase rugby union program is developed in this paper for the purposes of practically demonstrating the points and concepts put forward. However, the reader should be aware that the application of such a program will depend on the specific individual characteristics of the athlete and should be tailored to meet their individual characteristics and goals.

The effectiveness of a weight training program to achieve a specific training outcome (i.e., muscular endurance, hypertrophy, maximal strength, or power) depends on manipulation of several key training variables and training principles, these include: frequency, intensity, volume, and periodisation (Kraemer 1983; Bird, Tarpenning & Marino 2005).

Frequency

Frequency is the number of training sessions completed each week and will vary upon the phase of training cycle the athlete is in (Bompa 1990). The frequency of training is critical to get maximum benefits from the program, but must take into account the athletes other training commitments, as the season nears such as conditioning phase requirements, skill and team drills. Frequency recommendations (Table: 4).

Intensity

Intensity refers to the relative load or resistance that the muscle is required to work against. In the majority of weight training programs, intensity is expressed as a % of 1RM. This equates to the load lifted as a % of the maximum lift an athlete can lift once only. Intensity can also be measured by how many repetitions can be completed before failure (Bird, Tarpenning & Marino 2005). It should also be noted that the intensity can be increased by utilizing a heavier resistance or increasing the speed a given weight is moved. Increasing the intensity of an exercise by increasing velocity is important if the major goal is to increase the power output of the muscle and not just the ability to lift maximal

loads (Fleck & Kraemer 1987). Intensity recommendations for hypertrophy, strength and power (Table: 4).

Volume

Volume is the amount of work that is completed during a training session. Volume is most often calculated in strength training as repetitions x sets (Baker, Wilson & Carlyon 1994). Additionally, larger volumes of training appear to be most important when the main objective of the resistance program includes a decrease in fat mass and an increase in lean body mass or hypertrophy (Ostrowski et al. 1997). Volume recommendations (Table: 4)

Periodisation

The basic principle of periodisation is a shift in emphasis from high volume (Exercise × Sets × Reps) and low intensity (% of Max Effort) training to low volume and high intensity training. A good periodised plan is a subtle trade off among conflicting demands. The conventional approach has been to solve the program sequentially, for instance off season preparation with non specific strength training and after that changing to highly specific technique routines (Zatsiorsky 1995). The training year is divided into distinct phases known as mesocycles. Each mesocycle relates to a change in volume and intensity of training and may last 6 to 12 weeks depending on the athlete.

The initial mesocycle is the *hypertrophy phase* and consists of high volume, low intensity training. It is designed primarily to increase muscle mass, muscle endurance and to prepare the athlete for the more advanced training to follow. During the preparatory phase the athlete may perform additional conditioning activities such as jogging, swimming and cycling 2 to 3 times per week to

maintain cardiovascular endurance. The second mesocycle works on *maximal strength* and the third mesocycle concentrates on *power*. In these two mesocycles training intensity increases while training volume is reduced. During the strength phase training intensity is increased and volume is reduced to emphasize an increase in maximum strength. The power phase will incorporate Olympic based lifts such as Power Clean, Push Press and High Pull as these lifts create greater strength carry over for sport. Intensity increases further from the second mesocycle strength phase while volume as related to repetitions will decrease (Hoffman 2002).

Mesocycle One – Hypertrophy (8wks start October – end November)

Hypertrophy is the term we use to define muscle enlargement or growth. This enlargement is valuable to athletes involved in sports that require strength and power, such as rugby union (Brown 2002). The goal in this phase is to increase lean body mass and develop an endurance (muscular and metabolic) base for more intense training in later phases. The hypertrophy phase involves using loads of 60-80% of 1RM for novice and intermediate trainers, 70-100% of 1RM for advanced trainers with the emphasis on 70-80% of 1RM on a periodised program. This allows the athlete to perform more repetitions than is typical of a strength routine, but heavy enough load to elicit concentric or eccentric contraction failure within the 6-12 repetitions. However, it is not unusual in this phase for athletes to perform 12-20 successive sets that focus on one muscle group during a single session. (Conroy and Earle 2000) suggest that this higher training volume, coupled with low-moderate intensity may be critical for increasing muscle size. Therefore, hypertrophy is most efficiently produced through high volume, low intensity training, for example 3–5 sets of

8–12 repetitions at 60 to 75% 1RM with 1 - 2 minutes rest between sets and exercises (Hoffman 2002) and (Pearson et al 2000).

There is some variation stated in (ACSM Position Stand 2002) where 1-3 sets of 6-12 repetitions at 70-85% 1RM with 1-3 minutes rest.

The off-season (start October to end February) is the time to work on strength and size, and training should be devoted to maximizing this response in order to improve the physical variables that determine performance in rugby union (Doscher 2004). This also provides the opportunity to work on muscle imbalances (i.e., opposing muscle groups) as well as imbalances for your sport (i.e., upper and lower body discrepancies) and will include isolation type exercises. Intensity is lower in the hypertrophy phase than in strength and power phases, this allows the volume to be higher in this phase by increasing the total exercises performed per session and utilizing split routines such as upper and lower body workouts (Fry, Hakkinen & Kraemer 2002). (Tables 1a & 1b).

The hypertrophy phase is the ideal time to develop the athlete's endurance base. Rugby players require high levels of aerobic endurance to allow them to keep producing maximal efforts, recover quickly from sprints, rucks/mauls and to recover more effectively after matches and training sessions. To assist in reducing the impact stresses the body is subjected to in rugby union, training can be undertaken on equipment such as rowing machines, stationary cycles or treadmills. Swimming is another low impact activity that can be utilised to achieve an endurance training effect. This training can be implemented to coincide with upper body resistance training days if cycling or running. Swimming can be incorporated on lower body workout days, while rowing can be implemented on days weight training is not performed. By structuring the

program in this way the aerobic workouts will compliment the resistance workouts. A combination of steady state and interval training would be most effective. An example of the type of conditioning work required would be, 20-40 minutes of running, cycling, rowing or swimming at 65-75% of maximal heart rate. An interval session could involve 10 repetitions of 400m runs with 60 seconds rest, or 6 repetitions of 500m rowing with 2 minutes rest between repetitions. Circuit training with push/pull stations would be effective for players, as would varied cross training sessions to increase stimulation of body and mental attitude towards training. It is also advantageous to develop a technical base for speed training by introducing some speed drills to be utilised in upcoming training phases.

It is important to encourage the athlete to make this conditioning phase as enjoyable as possible, using cross-country runs, different and varied surfaces (dirt roads, grass, trails) as running on these surfaces is excellent for strengthening the ankles and surrounding muscles (Barnes 1993)

Mesocycle Two – Maximal Strength (6wks / start December - mid January)

Strength can be defined as the ability to apply force. Alternatively, another definition of strength is the ability to exert maximal force of the muscles that control particular body movements (Knuttgen & Komi 2003). Every athlete has performance qualities that can be enhanced by a strength program. These qualities, when trained determine our level of success in our chosen sport (Dintiman, Ward & Tellez 1997). Therefore, the development of strength should be a central component for any athlete committed to improving performance (Bompa 1983). Strength in some form is associated with every sport, team or individual. Therefore it is important to develop a general

strength base and to then enhance this base with a sport specific regime. Furthermore, it is important that strength training exercises selected for a routine follow specific movement patterns and/or muscle actions involved in rugby union.

A source of confusion when designing a resistance exercise program is the vast amount of exercise options available. When designing a maximal strength program, it is essential to utilize and evaluate the many options, which will include the best exercise option to meet the objectives. Strength training program design should be based around multi joint and structural compound exercises such as bench press, squat and deadlift (Fry, Hakkinen & Kraemer 2002).

As stated in (Newton et al 1996) performing speed and power repetitions with isolated joint exercises may well reduce power development, as the body would attempt to slow the mass down prior to the end of range of motion. Exercises such as power cleans and many olympic lifting exercises gain acceptance for power training as they did not have the problem with protecting the joints since mass could be accelerated naturally up the linear line of the body (Kauhanen & Hakkinen 1989).

Appropriate exercise selection must involve the relevant musculature for the sport being trained to compete in, as well as the primary and secondary movers for the sport, as well as the synergistic muscles critical for optimal performance. Rugby is a full contact sport utilising many multi-joint actions or movements. Compound exercises such as squats, deadlifts and power cleans are advantageous as they utilise recruitment patterns similar to specific positions within the game. An example would be the squat for the front rowers engage position and power cleans as specific to the second rower for lineout jumping.

Strength according to (ACSM Position Stand 2002) can be achieved by 1-multiple sets, 1-12 repetitions at 60-100% with rests between 2-3 minutes. (Pearson et al 2000) recommends 3-5 sets, 5-6 repetitions at 80-88% 1RM with rests 3-5 minutes. As stated by (Bompa 1983). maximal strength is achieved by 3-5 sets, 1-5 repetitions at 90-100% of 1RM with rests between 2-5 minutes. Additionally, (Bompa 1990) suggests that maximal strength can be converted to power in a relatively short time. Therefore, the conclusion of the strength phase is followed by a transition into the power phase in order to prepare the athlete for competition (Tables 2a & 2b).

The strength phase is the time in the training program to start to develop a tolerance for high intensity activity. Fartlek training can be utilised in developing those tolerances. In Fartlek training, distances for long interval training are used. This type of training involves running specified distances such as 300 – 400m in a given time at 70-80% of maximal effort with walk back recoveries or rest periods of 2mins. An example workout would be over 400m distance, 2 sets of 5 repetitions at 70-80% of maximal effort, 100m-walkback recovery between repetitions and 3mins recovery between sets.

At this stage the long interval training would be completed 2 times a week (non-leg training days in weights program). Also include 1 workout per week of a slow endurance run of 20-40 minutes at 60-70% maximum heart rate on same day but following lower body weights program (eg weights morning and run afternoon) in the training week.

Mesocycle Three – Power (6wks / mid January – end February)

Power has been defined as the optimal combination of speed and strength to produce movement (Chu 1996). Power is what allows the rugby union player to break and execute tackles, get to breakdowns with speed and explosive force and to commit to the general physical confrontations they face in their individual positions. However, it is important that prior to commencing a sport specific power routine the athlete has undertaken a specifically designed strength routine to ensure their readiness for this phase. It is essential that a solid measurable strength base is established before the power development routine. Projected 1RM for the squat is a reliable, repeatable protocol that can be utilised to assess the athlete's progress against their own bench mark. There are a variety of tests to monitor muscle power and/or endurance such as repeated sit-ups or push-ups, and although these tests can be performed within a group of players, there are concerns over their standardisation, reliability and validity. Tests that have a strong validity and proven reliability, such as the vertical jump, would be highly beneficial in the assessment of the rugby players power. The vertical jump is also an easy test to utilise for monitoring the leg power in rugby players (Duthie et al 2003). It is important to determine if the athlete possesses a general strength level, and once established, a power program can be implemented (Fleschler 2002).

Power development comprises producing a large force at high rate of speed, and can be divided into 2 areas of movement. Firstly, speed strength is where importance is on speed of movement against relatively small resistance. A good example of this is plyometrics. The second is where a quick application of force against a large resistance, such as Olympic lift movements. The Olympic lifts are extremely effective at building inter-muscular co-ordination, as the lifts

are multi-joint and must have precise timed contraction and relaxation of opposing muscle groups to provide smooth, fluid movement and force application. The power clean is a dynamic lift designed to increase power production (Fleschler 2002).

Resistance exercises can be selectively used to train for explosive sports such as rugby union, but it is important to be aware that there is a fine balance of training speed and loads that must be observed to get maximal transfer to a specific sport (Dintiman, Ward & Tellez, 1997). Moreover, many resistance exercises can be used to develop functional strength and power, with the Olympic lifts and their variations, involving maximal contractions of large core muscle groups, being the most important of the exercises. Olympic lifts are the most commonly recommended exercises in power and speed programs; furthermore athletes trained in Olympic style lifting techniques have an extremely high capacity to develop power, which is necessary for success in sport (Garhammer 1985). In addition, proper lifting technique teaches good fundamental body mechanics that are quite adaptable to many sports.

Rugby specific strength programs from the University of California emphasize increasing strength and size of the shoulders, chest, back and arms. Increase strength and core stability of the trunk and lower body, optimizing explosive power projection. Finally, ensure muscle balance between both the knee and hip extensors and flexors (Barnes 1993). A well-designed program includes exercises for all major muscle groups. Because athletes tend to work their strengths and avoid weaknesses in training, the strength coach needs to ensure they address their weaknesses or imbalances at the outset of their program (Wathen 1994) Suggested ratios for agonist and antagonist (Table 5). The criteria for power training as stated in (ACSM Position Stand 2002) is

1 – multiple sets, 1-12 repetitions at >80% power or 30-60% for velocity. Training recommendations for the power phase (Baechle, Earle & Wathen 2000). include 3-5 sets, 4-6 repetitions at 90-100% 1RM. Power training as stated by (Pearson et al 2000) is achieved at 3-5 sets, 2-4 repetitions at 90-95% with 2-3 minutes rest. The later studies confirm the strength and conditioning science is a continually evolving profession.

The power phase is designed to optimize the gains in strength your athlete has made during the maximal strength phase. Prior to competition the aim is to utilize the strength gains and work to increase the power output. The effect is a stronger faster athlete that can utilize their individual skills at a more competitive level. The benefits may also include a more confident and competitive athlete from the belief they have in themselves after completing a structured and well designed program as well as a physically better prepared athlete (Table 3a & 3b).

In this last phase prior to the competition phase the conditioning work becomes more intense and specific. This phase will incorporate more high quality interval work over distances ranging from 20-200m. This allows improvement in the athlete's ability to work at near maximal outputs with rugby specific recovery intervals. Hill running or stair climbing is advantageous in this phase as it is used as a speed enhancement drill because of it's higher or exaggerated hip flexion. The rugby match lasting up to 90 minutes will include many short sharp bursts of high intensity. Therefore, conditioning for these intervals is essential in developing sprint/speed endurance (Barnes 1993).

This high intensity work is carried out at 80-90% of maximal effort and can be interspersed with sessions of active recovery. An example session could involve a distance of 200m, 1 set of 6 repetitions at 80% intensity with 2mins

rest between repetitions, followed by distance 150m, 1 set of 4 repetitions at 85% intensity and 90 seconds recovery, followed by 100m distance 1 set of 3 repetitions at 85% intensity with 60 seconds recovery.

This is the optimal time to incorporate game specific drills and running patterns to utilise the benefits achieved from the periodised program to date for the upcoming competition phase.

Conclusion

The better prepared the athlete is physically to run, tackle, scrimmage and participate in all aspects of rugby union, the lower the chances of injury. As you strengthen the body through strength training routines to improve hypertrophy, strength and power, the added benefit is that these strength improvements reduce the chance of injury (Pauletto 1993). The training stimulus has to be constantly varied to optimize the development of strength, if the training stimulus is constant, it will be ineffective and the athlete will become stale and gains will be reduced (Poliquin 1988). Variation throughout the strength training program can be achieved by manipulating a number of variables such as sets, repetitions, speed of movement or rest intervals, the program variables are indicated in Table: 4 (ACSM Position Stand 2002). Manipulation within these guidelines ensures variety whilst remaining within the set criteria of the specific phase you are training. The other options are to change exercises or order of exercises (Poliquin 1988). As outlined by (Baker 1993), a periodised strength program is the most effective way of changing the training stimulus, and this should be viewed as an essential component of effective program design.

Rugby Union requires a strong body core to stabilize the trunk and help maintain correct posture while changing direction at speed or in contact phases. It is essential to also have strong core stability to efficiently transfer force from the ground during contact. As the competition phase approaches greater demands are placed on the athletes for technical and tactical aspects of rugby union. As such, strength training can be forced to receive less importance from the head coach. Therefore, we, as strength and conditioning coaches, need to be mindful of time constraints and be able to implement

programs that are both practical and time efficient whilst still being able to achieve the goals in hypertrophy, strength and power.

Table 1a.**Example Workout for Hypertrophy (8wks)****Wks 1 - 4**

Frequency: 4 x week

Volume: 3 – 5 sets

Intensity : 8 – 12 RM

Rest: 1min between exercises

Monday

| Exercise | Sets | Reps |
|----------------------|-------------|-------------|
| Bench Press | 3 | 10 |
| Bent Over Row B/Bell | 3 | 10 |
| Shoulder Press | 3 | 10 |
| Shrugs | 3 | 10 |
| Bicep Curl B/Bell | 3 | 10 |
| Tricep Extension | 3 | 10 |
| Crunches | 3 | x |

Tuesday

| Exercise | Sets | Reps |
|---------------------|-------------|-------------|
| Squat | 3 | 10 |
| Deadlift | 3 | 10 |
| Leg Curl | 3 | 10 |
| Standing Calf Raise | 3 | 10 |
| Back Extension | 3 | 10 |
| Reverse Crunch | 3 | x |

Thursday

| Exercise | Sets | Reps |
|-----------------|-------------|-------------|
| Incline Press | 3 | 12 |
| Dips | 3 | 12 |
| Lat Pulldown | 3 | 12 |
| Seated Row | 3 | 12 |
| Upright Row | 3 | 12 |
| Bicep Curl | 3 | 12 |
| Tricep Pushdown | 3 | 12 |
| Crunches | 3 | x |

Friday

| Exercise | Sets | Reps |
|-----------------------|-------------|-------------|
| 45° Leg Press | 3 | 12 |
| Front Squat | 3 | 12 |
| Leg Curl | 3 | 12 |
| Single Leg Calf Raise | 3 | 12 |
| Stiff Leg Deadlift | 3 | 12 |
| Reverse Crunch | 3 | x |

Table 1b.**Example Workout for Hypertrophy****Wks 5 - 8**

Frequency: 4 x week

Volume: 3 – 5 sets

Intensity : 8 – 12 RM

Rest: 1min between exercises

Monday

| Exercise | Sets | Reps |
|---|------|------|
| Bench Press D/Bell | 4 | 8 |
| Flyes D/Bell | 4 | 8 |
| One Arm Row | 4 | 8 |
| Upright Row | 4 | 8 |
| Rotator Cuff Raise D/b Internal/External | 4 | 8 |
| Chin ups | 4 | 8 |
| Tricep Extension | 3 | 8 |
| Hanging Leg Raise | 3 | x |

Tuesday

| Exercise | Sets | Reps |
|------------------------|------|------|
| Deadlift | 4 | 8 |
| Lunges D/Bell | 4 | 8 |
| Single Leg Curl | 4 | 8 |
| Seated Calf Raise | 4 | 8 |
| Back Extension | 4 | 8 |
| Crunches (swiss ball) | 3 | x |

Thursday

| Exercise | Sets | Reps |
|---------------|------|------|
| Bent Over Row | 4 | 6 |
| Decline Press | 4 | 6 |
| Lat Pulldown | 4 | 6 |
| Push Press | 4 | 6 |
| Dips | 4 | 6 |
| Bicep Curl | 4 | 6 |
| Prone Hold | 4 | 1min |

Friday

| Exercise | Sets | Reps |
|-----------------------|------|------|
| Split Squat | 4 | 6 |
| Hack Squat | 4 | 6 |
| Leg Curl | 4 | 6 |
| Stand Leg Calf Raise | 4 | 6 |
| Crunches (swiss ball) | 3 | x |

Table 2a.

Example Workout for Strength (6wks)

Wks 1 – 3

Note: Wks 1 lower body x 2- upper body x 1 / Wk 2 Upper x 2 – lower x 1

Frequency: 3 x week

Volume: 3 – 5 sets

Intensity : 4 – 6 RM

Rest: 2-3 mins multi-joint ex / 1min assisted lifts

Monday

| Exercise | Sets | Reps |
|-------------------|-------------|-------------|
| Squat | 4 | 6 |
| High Pull | 4 | 6 |
| Lunges D/Bell | 4 | 6 |
| Back Extension | 4 | 6 |
| Hanging Leg Raise | 3 | x |

Wednesday

| Exercise | Sets | Reps |
|----------------------|-------------|-------------|
| Bench Press | 4 | 6 |
| Chin-Ups (weighted) | 4 | 6 |
| Stand Shoulder Press | 4 | 6 |
| Bent Over Row | 4 | 6 |
| Reverse Crunch | 3 | x |

Friday

| Exercise | Sets | Reps |
|------------------|-------------|-------------|
| Front Squat | 5 | 6 |
| Deadlift | 5 | 6 |
| Step-Ups D/Bells | 5 | 6 |

Table 2b.

Example Workout for Strength

Wks 4 – 6

Frequency: 3 x week

Volume: 3 – 5 sets

Intensity : 4 – 6 RM

Rest: 2-3 mins multi-joint ex / 1min assisted lifts

Monday

| Exercise | Sets | Reps |
|-------------------|-------------|-------------|
| Squat | 5 | 5 |
| Deadlift | 5 | 5 |
| High Pull | 5 | 5 |
| Back Extension | 5 | 5 |
| Hanging Leg Raise | 3 | x |

Wednesday

| Exercise | Sets | Reps |
|-----------------|-------------|-------------|
| Bench Press | 5 | 5 |
| Lat Pulldown | 5 | 5 |
| Shrugs | 5 | 5 |
| Dips (weighted) | 5 | 5 |
| Prone Hold | 3 | 1min |

Friday

| Exercise | Sets | Reps |
|------------------|-------------|-------------|
| Front Squat | 5 | 5 |
| Deadlift | 5 | 5 |
| Step-Ups D/Bells | 5 | 5 |

Table 3a.

Example Workout for Power (6 wks)

Wks 1 – 3

Frequency: 2 x week

Volume: 3 – 5 sets

Intensity : 2 – 5 RM

Rest: 2-3 mins multi-joint ex / 1min assisted lifts

Monday

| Exercise | Sets | Reps |
|---------------------|-------------|-------------|
| High Pull | 3 | 3-4 |
| Push Press | 3 | 3-4 |
| Deadlift | 3 | 3-4 |
| Bench Press | 3 | 3-4 |
| Crunches (fitball) | 3 | x |

Thurs

| Exercise | Sets | Reps |
|-------------------|-------------|-------------|
| Power Clean | 4 | 3-4 |
| Squat | 4 | 3-4 |
| Bench Press | 4 | 3-4 |
| One Arm Row | 4 | 3-4 |
| Sit Up (bent leg) | 3 | x |

Table 3b.

Example Workout for Power

Wks 4 – 6

Frequency: 2 x week

Volume: 3 – 5 sets

Intensity : 2 – 5 RM

Rest: 2-3 mins multi-joint ex / 1min assisted lifts

Monday

| Exercise | Sets | Reps |
|----------------------|-------------|-------------|
| High Pull | 5 | 3 |
| Squat | 5 | 3 |
| Push Press | 5 | 3 |
| Ballistic Push-Ups | 5 | 3 |
| Crunches (med ball) | 3 | x |

Thursday

| Exercise | Sets | Reps |
|-------------------|-------------|-------------|
| Power Clean | 5 | 3 |
| Squat | 5 | 3 |
| Bench Press | 5 | 3 |
| Hanging Leg Raise | 3 | x |

Table 4: Summary of resistance training recommendations: overview of different program variables needed for progression with different fitness levels

| | Muscle Action | Selection | Order | Loading | Volume | Rest Intervals | Velocity | Frequency |
|--------------------|---------------|-------------------------|--------------------------------------|---|---|--------------------------------|------------|-----------|
| Strength | | | All levels | | | All levels | | |
| Novice | Ecc & Con | SJ & MJ ex | Large<small | 60-70% 1RM | 1-3 sets, 8-12 reps | 2-3mins for core | S,M | 2-3x/week |
| Intermediate | Ecc & Con | SJ & MJ ex | MJ<SJ | 70-80% 1RM | Multi sets, 6-12 reps | 1-2mins for other | M | 2-4x/week |
| Advance | Ecc & Con | SJ & MJ ex- Emphasis MJ | Hi<Li | 1RM - PER | Multi sets, 1-12 reps-PER | | US-F | 4-6x/week |
| Hypertrophy | | | All levels | | | | | |
| Novice | Ecc & Con | SJ & MJ ex | Large<small | 60-70% 1RM | 1-3 sets, 8-12 reps | 1-2 min | S,M | 2-3x/week |
| Intermediate | Ecc & Con | SJ & MJ ex | MJ<SJ | 70-80% 1RM | Multi sets, 6-12 reps | 1-2 min | S,M | 2-4x/week |
| Advance | Ecc & Con | SJ & MJ ex- Emphasis MJ | Hi<Li | 70-100%1RM emphasis 70-85%- PER | Multi Sets, 1-12 reps emphasis 6-12 reps-PER | 2-3min-VH 1-2min-L-MH | S,M,F | 4-6x/week |
| Power | | All levels Mostly MJ | All levels Large<small | All levels Heavy load>80%-strength Light(30-60%)-velocity-PER | Train as for strength | All levels 2-3mins for core | | |
| Novice | Ecc & Con | | | | | | M | 2-3x/week |
| Intermediate | Ecc & Con | | Most complex<least complex | | 1-3 sets,3-6 reps | 1-2mins for other | F | 2-4x/week |
| Advance | Ecc & Con | | Hi<Li | | 3-6 sets, 1-6 reps-PER | | F | 4-6x/week |
| Endurance | | | All levels | | | All levels | All levels | |
| Novice | Ecc & Con | SJ & MJ ex | Variety in sequencing is recommended | 50-70% 1RM | 1-3 sets, 10-15 reps | 1-2mins high rep sets | S-MR | 2-3x/week |
| Intermediate | Ecc & Con | SJ & MJ ex | | 50-70% 1RM-PER | Multi sets 10-15 reps or more | <1min for 10-15 reps | M-HR | 2-4x/week |
| Advance | Ecc & Con | SJ & MJ ex | | 30-80% 1RM-PER | Multi sets 10-25 reps or more-PER | | | 4-6x/week |

Ecc:eccentric
SJ:Single joint
ex:exercises

Con:concentric
MJ:multiple joint
Hi:high intensity
Li:low intensity

1RM:1-repetition maximum
PER: periodised
VH:very heavy
L-MH:light to mod heavy

S:slow
M:moderate
US: unintentionally slow
F:fast

MR:moderate repetitions
HR:heavy repetitions

Source: Position Stand 2002. American College of Sports Medicine pp374

Table 5.

Agonist – Antagonist Ratios (concentric isokinetic movements)

| Joint | Strength Training | Torque Ratio |
|---------------------|--|---------------------|
| Ankle | Plantar flexion / Dorsi flexion Gastrocnemius, soleus / Tibialis anterior | 3:1 |
| Ankle | Inversion / Eversion Tibialis anterior / Peroneals | 1:1 |
| Knee | Extension / Flexion Quadriceps / Hamstrings | 3:2 |
| Hip | Extension / Flexion Spinal erectors, gluteus maximus, hamstrings / Iliopsoas, rectus abdominus, tensor fascia latae | 1:1 |
| Shoulder | Flexion / Extension Anterior deltoids / Trapezius, posterior deltoids | 2:3 |
| Shoulder | Internal / External rotation Subscapularis / Supraspinatus, infraspinatus, teres minor | 3:2 |
| Elbow | Flexion / Extension Bicep / Tricep | 1:1 |
| Lumbar Spine | Flexion / Extension Psoas, abdominals / spinal erectors | 1:1 |

Source: Wathen, D (1994) Muscle Balance. In: **Essentials of Strength Training and Conditioning** T.R. Baechle (eds.), Champaign, IL; Human Kinetics 24 ;pp:425

Table 6: Distribution and Length of Training phases in Rugby Union training year

| Month | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|-----------|---------------------------------|-----|--|---------------|-------|------------------------------|-----|-----|-----|-----|--------|------|
| Period | Off-season | | | Pre- season | | In-season | | | | | | |
| | General Preparation | | | Specific Prep | | Main Competition | | | | | Finals | |
| Strength | Hypertrophy General Strength | | Maximal Strength | | Power | Maintenance - Strength/Power | | | | | | |
| Speed | Speed Technique | | Specific speed and agility | | | Maintenance - Speed/agility | | | | | | |
| Endurance | Aerobic Endurance | | Development specific endurance and anaerobic capacity | | | Maintenance - Endurance | | | | | | |

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