

STRENGTH AND POWER

By

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This article largely consists of extracts from a chapter on ‘Strength and Power’ in his new book, ‘The RFU Guide for Coaches – Fitness and Conditioning’. Details of that book appear at the end of the article.

Many rugby clubs have invested in weights rooms to encourage players to develop their strength and power to increase the physicality of their game. Tackling, lifting, scrummaging, winning collisions, mauling and wrestling for possession are some of the situations in which physical strength is critical for successful performance.

Players quite often follow an ad hoc training programme where they perform a random set of exercises that they have seen other people carrying out, often with no monitoring or progression of their training. They also religiously perform ‘bench weights’, focusing on a couple of body parts to the exclusion of all others. This will improve physical appearance but will have a limited benefit on rugby specific strength and performance.

As with any form of training, it is vital that technique and basic movement are learned and perfected before increasing the difficulty of the exercise or the resistance. This is especially so when working with weights, due to the risk of injury that performing this type of training incorrectly can result in. Always consult a suitably qualified instructor before embarking on a resistance-based programme and develop safe practice, technique, stability and strength before attempting to develop power.

Strength, power and the young player (LTAD – Long Term Athlete Development)

There is no definitive answer as to when a player should begin weight training. Children have individual rates of development – as such they can be the same age but can be at significantly different stages of physical development. Only players who are mature beyond their chronological age should consider using resistance above their body weight before the age of 17. Body weight resistance such as press-ups, dips and pull-ups are adequate strength development for those whose physical development is not ahead of their chronological age.

However, there is no reason why children cannot be taught the correct lifting techniques from a young age – a broomstick can replace the bar and the technique developed. When they are physically mature enough to begin lifting, they are then competent with the movement patterns and will be able to make more rapid progress.

The most likely causes of injury for a young player carrying out a strength- training programme are exactly the same as for adults:

- Poor technique.
- Unsupervised training where bad habits are not corrected.
- Lifting weights that are too heavy.
- Using apparatus inappropriate to his size.

Growth plates

As the bones are growing and forming, they are more susceptible to damage as the newly forming cells are weaker than the surrounding bone. Damaging these cells can cause deformation of the limb or prevent further bone growth occurring. This has been the main reason for opposition to young persons taking part in strength-training programmes.

RFU guidelines for weight training for U17 players

1. Programmes must be devised and overseen by a suitably qualified instructor.
2. The player must be physically mature, probably in advance of his chronological age and playing at representative level.
3. Correct technique is of paramount importance and no weight should be used until the technique is correctly learned.
4. Moderate loadings should be used with high repetitions with the aim of developing muscular endurance (12-15 repetitions).
5. A mix of single joint and multi-joint exercises should be used to work all the major muscle groups.

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If there is any doubt about the readiness of a young player to undertake a strength-training programme, then err on the side of caution.

(Club England Fitness Team, 2000)

Developing strength and power

Strength is defined as the ability of a muscle or group of muscles to exert force to overcome a resistance, and is generally expressed in the weights room as a 1 rep max (the maximum weight you can perform once on a given exercise). Power is a combination of speed and strength – essentially, the quicker you can perform a strength-based action with control the more powerful you are.

Rugby involves strength and power to be performed in a number of different ways during a game. There is static (isometric) strength when the muscles are contracting and tense but there is no movement around the joint. Maintaining a good scrummaging position or holding on to a ball in a maul are examples of this type of strength; this can be developed by applying resistance at a fixed angle. In rugby, static strength revolves around core stability/strength and wrestling/grappling activities.

The majority of the muscle actions we perform when walking, running and jumping are isotonic – they have a concentric phase (the muscle contracts and shortens) and an eccentric phase (the muscle lengthens). Most weight training follows this principle with a weight being lowered or raised, causing the muscles working to produce more force to shorten or lengthen.

Principles of weight training

The principles of training are the same for any component of fitness – when attempting to develop strength and power it is particularly important to follow these laws.

Overload

Muscles must be made to work beyond a level that they are accustomed to in order for any improvement from training to occur. In weight training, this needs to be a progressive overload – once the muscles have adapted so they can cope with the weight being lifted, it needs to be increased in order to promote further adaptation and muscular improvement. Strength training does not result in more muscle fibres being produced; these numbers are genetically determined. Muscle fibres become thicker and stronger

(hypertrophy) as a result of training, which accounts for the changes in size and muscular definition a person experiences.

Adaptation

The initial improvements from weight training are primarily due to intermuscular coordination (2-4 weeks) and then from adaptations in the neural pathway (6-8 weeks).

This brings about an increase in the number of muscle fibres recruited during the exercise and the efficiency in which they are activated.

It is only after 10 weeks or more of regular weight training that muscle hypertrophy becomes apparent. The muscle fibres' greater size allows for more force to be applied during a single contraction.

Specificity

In order to make strength or power gains, the appropriate forms of training need to be undertaken. Lifting light weights will not bring about the same strength gains as lifting heavy weights, thus training needs to be specific to your goals.

Reversibility

If the system of progressive overload is not followed then further gains will not be made. If training ceases then the gains will quickly be lost and the adaptations of muscle strength and size will reverse (atrophy).

Frequency

In order to bring about significant improvements in strength and power, a programme of regular training needs to be undertaken. Individual experience and goals will determine the level and type of training, but three or four sessions should ideally be performed in the pre-season. This will maximise the gains made before other training demands reduce the time that can be devoted to strength and power development. In season, players should attempt to perform at least two sessions a week to maintain and develop the gains that the early season training has brought.

Recovery

When performing resistance training, suitable recovery periods need to be observed between workouts in order for adaptation and recovery to take place. When first undertaking such a programme, players will require two or three days in order to fully recover from their exertions. The body will quickly become used to the training and anything between 24 and 48 hours is generally a sufficient period of rest before commencing the next training session. Having three or four days rest included at points in the training year, particularly after a period of intense training, will not cause atrophy or

detraining to occur. It may actually be beneficial, both mentally and physically to the player to have these breaks in training to allow him to resume the next cycle renewed and refreshed.

Muscle fibres

Muscle fibres are classified into two main categories based on the speed that they contract: fast twitch and slow twitch. All muscle groups are made up of these different types of fibres – the percentages of the types you have are determined by genetics and can be altered by the type of exercise you perform. Slow-twitch fibres are recruited first in any activity and only if the load is great enough will the faster fibres be recruited. Thus in order to develop these fibres, training needs to be performed with heavy loads in order to bring about maximal strength and power development.

Fast twitch

Type 2b: these are easily fatigued but have a high capacity for anaerobic work and contract quicker than other fibre types, making them most desirable for strength, speed and power-based activities.

Type 2a: though not contracting with the same speed and force as type 2b fibres, these are largely responsible for the ability to produce strength and power. With power training these can begin to operate more like type 2b fibres.

Slow twitch

Type 1: these are highly resistant to fatigue and have a large capacity for aerobic metabolism that makes them ideal for endurance-based activity.

How to train strength and power for rugby

When you think of weight training you immediately visualise a room with lots of machines and the traditional exercises such as bicep curl, bench press, leg extension and

so on. Many of these exercises isolate single muscle groups in order to place them under strain to facilitate strength gains. All of these exercises will result in improved strength and size if performed properly and with the correct frequency and progressive overload.

Now think of a game of rugby – when do you perform a bicep curl, bench press or leg extension during the course of a game? When do you only work one particular muscle group in isolation from all others in the body? You need the strength that these exercises bring to these body parts, but how functional are they to the actions that are performed on the pitch? A lot of these exercises are performed sitting or lying down and, as such, do not represent the way that strength needs to be applied during the game when you are standing. I am not saying that these exercises hold no place or value in strength training, just that there are ways to train that will enable a greater degree of transfer into sporting situations. It makes sense to train in a way that best reflects the demands of the sport.

Functional training

Functional training essentially promotes multi-joint activity. By training in this way, players have to develop balance, stability and joint coordination and manage their body weight whilst performing an exercise. These are all required whilst performing any rugby based skill, so training to develop strength in this way will have an increased benefit on performance over single-joint exercises. Most functional exercises are performed standing with the feet in contact with the ground (closed chain) to reflect the demands of the sport and the fact that the body, not a machine, needs to provide stability whilst performing an action. There are many occasions in sport when the body is in an unstable position and the athlete needs to be able to control this. Functional training reflects this need and encourages the progression of certain exercises on an unstable surface, such as using one leg, jelly discs or foam pads to stand on.

As much as possible, exercises that reflect the demands of the sport should be used to develop strength. Functional training is an excellent means of achieving this and will develop strength and improvements in balance and coordination that traditional isolation training cannot. This will also help reduce the risk of injury as players develop better body control.

General guidelines for weight training.

Training For	Sets	Reps	% 1 Rep Max	Recovery Time
Power	3-5	1-6	85-100%	3-5 min
Strength	3	6-12	70-85%	2-3 min
Muscular Endurance	3	15-20	50-60%	45-90 sec

Variety in the types of exercises incorporated and structure of training programmes is important in developing strength and power gains. Variety helps to stimulate the players; performing the same programme, exercises, reps and sets is not only boring but will not bring about the same strength gains as a programme that changes and places the muscles under different stresses, thus leading to greater adaptation.

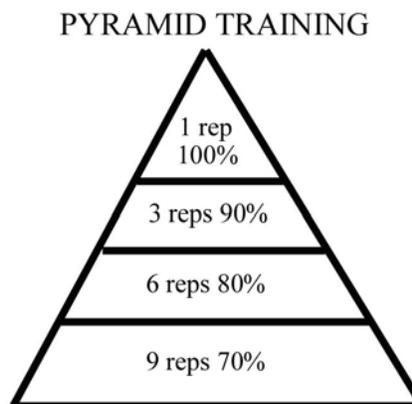
Below are two different types of programming that can be used to alter a training programme.

Supersetting

This can take on two forms. Firstly, to perform exercises that work the same muscle group directly after the other with no rest period, e.g. Bench Press followed directly by Dumbbell Fly. This is highly fatiguing and so would result in a lower weight being lifted due to the lack of a recovery period between exercises. Secondly, to work opposing muscle groups in the same manner, e.g. Bench Press followed directly by Bent over Row. This is a popular method of training as it means more exercises/sets can be performed in a short period of time.

Pyramids

In this form of training, the weight begins heavy and a low number of repetitions are performed; the weight is then decreased and a higher number of repetitions is carried on. This can be performed starting from low weight to high with the repetitions being decreased. For strength gains, the heavy to light approach allows for greater improvement as the muscles are not fatigued when they come to perform the heavier lifts.



Why develop power?

Once a player has developed a good strength base with sound technical execution, he should look to develop this into explosive power. Strength training is important to rugby but power is the key that unlocks the door to releasing a player's athletic potential. Rugby is a sport that is made up of collisions and contacts, when strength needs to be applied at speed in order to make a tackle, break a tackle, clear a ruck or lift a jumper.

Power = Speed x Strength

To develop power it is the speed at which strength is applied that is critical. This is referred to as the Rate of Force Development (RFD) – the greater the RFD of an individual, the more power he can produce. The RFD in strength training is slow and as such does not transfer into power that can be applied in a game. Therefore, in order to bring about improvements, training needs to target RFD.

England Conditioning Coach, Dave Reddin, believes that the power benefits associated with using light weights to facilitate greater speed of movement result more in muscular coordination improvements than increases in the muscular force development. Power training requires RFD to be increased – the weight used needs to be high in order to recruit as many muscle fibres as possible and to specifically target the fibres which can produce the greatest force (type 2b muscle fibres). Whereas the muscles are forced to contract very quickly in order to reach their peak force, it is the speed of the muscle contraction not the speed that the weight is lifted that is the key to power development.

Power training for rugby is required for one-off actions such as tackling or lifting, but due to the nature of the game a player will be required to make a number of powerful movements in one passage of play. It is, therefore, necessary to ensure that power training reflects this and is not solely focussed on one-off maximal lifts.

Power training is dependent upon quality and intensity rather than quantity. Training without these principles and with long rest periods will not bring about the desired improvements in power production. For maximum benefit and safety, power lifts should be performed at the beginning of a weights session after a suitable warm-up and stretching and before the body is fatigued. Fatiguing core exercises should be performed after these lifts for the same reason.

There is a fear that by carrying out power training, players will put on weight and will be unable to move around the pitch. However, this is not the case. It will increase speed, acceleration and explosive movement, which is why it is such a major part of sprint training programmes. Performing such multi-joint activities will also make players more resistant to the rotational and lateral forces they will experience in a game, providing a positive influence on reducing the risk of injury.

Complex and contrast training

This method of training couples strength training with a plyometric-based exercise in order to recruit more muscle fibres and therefore bring about improvements in RFD. It is also a more functional way of training as the exercises will have a greater relevance to actions carried out on the pitch. A resistance exercise for a specific muscle group is performed and then a plyometric exercise for this muscle group follows.

The resistance exercise provides an initial stimulus that activates motor units and muscle fibres. As a result, the neural system is in a state of readiness leading to greater recruitment of muscle fibres in the following plyometric exercise, e.g. Bench Press is followed by Drop Press-ups, Back Squat is followed by Box Squat Jumps, Lunge is followed by Single Leg Hops. The player would complete all the prescribed sets of the resistance exercise before moving on to the plyometric exercise and performing the desired number of sets.

Contrast training works on the same principle as complex training, except that the resistance and plyometric exercises are performed on the lines of the super set principle. The resistance exercise is performed and then, after a minute to a minute and a half's rest period, the plyometric exercise is performed. This is a high-intensity form of training and should not be attempted until a base level of strength has been established.

Allow 3-5 minutes rest between the superset exercises and commencing the next superset.

The rugby season is not best suited for developing strength and power gains. There is only a short period out of competition when this component of rugby fitness can receive the required attention. In season, playing and recovering from games and the time constraints on the individual and the team mean that gains made during the off season are often at best only maintained during the season. As a result, developing gains in strength and power takes a number of years of planned training in order to cope with the difficulties that the structure of the rugby season presents.

Programmes need to contain a mix of pushing and pulling exercises, working all the major muscle groups to prevent imbalance that can result in injury. The following exercises are appropriate for the inclusion in a rugby player's training programme and, with the correct planning and prescription, will help to bring about strength and power gains.

Safety and weight training

- All programmes should be prescribed by a suitably qualified trainer, with technical execution taking precedence over the amount of weight lifted.
- Exercises should be performed with body weight as resistance to facilitate this, before gradually increasing the external load or instability.

- Assess individual lifting competency, experience, strengths and weaknesses when designing a programme.
- Wear appropriate clothing and footwear and train in an appropriate environment with the correct equipment. Check all equipment before use for faults or damage.
- Always use collars to secure weights in place and work with spotters when using free weights.
- Carry out a suitable warm-up and cool-down.
- If you experience pain when lifting, stop exercising, visit the medical staff and have your trainer review your technique.

Plyometric training

By introducing plyometric training into a power-based programme, you will develop greater gains than by weight training alone. This is a particularly demanding form of training and should only be attempted by well-conditioned athletes with a good strength base. The training places the joints, bones and muscles under great strain and so the infrequent trainer and children/teenagers who are still growing should not perform this type of training.

Plyometric exercises require the muscles to perform an eccentric contraction (contract and lengthen) at high speed to recruit the fast-twitch fibres in large numbers. This eccentric phase occurs when the muscle is working against gravity and is used as a braking mechanism to slow the body or limb down. This results in greater tension and force production in the muscle and is then immediately followed by a concentric contraction (muscles contract and shorten) that propels you away from the ground. It is often referred to as the stretch-shortening cycle.

Basic rules for plyometric training:

1. Be physically ready to cope with the demands of this type of training.
2. Players should be able to squat 1½ times their body weight before undertaking the more intense forms of plyometrics.
3. Players need to possess good core stability and be flexible. Players who demonstrate muscle weakness and instability should undergo appropriate corrective work before progressing with a plyometric programme.
4. Perform the activity on an appropriate surface – grass is one of the best surfaces for performing plyometric training.
5. Wear footwear that provides appropriate support.
6. Land with a locked ankle and with at least two-thirds of the foot in contact with the ground, with the weight on the front of the foot.
7. Perform a thorough warm-up and cool-down at the beginning and end of each session.
8. Technique is critical and sessions should be short with long recovery periods, due to the intensity of the exercise and the effect fatigue will have on performance.
9. Allow at least 48 hours between plyometric sessions for the body to recover.

Plyometrics for rugby

As a basic guide, 3-10 repetitions and 2 or 3 sets of the exercise (4-6 exercises per session) should be performed, depending on the training aims and level of difficulty. Start gradually and build up the volume of work, but remember it is the intensity and quality of work that is important. As soon as a player is showing signs of fatigue, there is no point in continuing as the benefits will be minimal and they are more disposed to injury.

Recovery times between sets of between 2 or 3 minutes are generally sufficient but can be increased or reduced depending on the difficulty of the exercise.

Progressing strength and power training

This table provides some basic guidance on the way in which strength and power training can be structured and progressed. This is highly dependent upon individual growth, development, commitment and competence. The rate that players progress will vary greatly and it can take a number of years of regular and continuous training to become an advanced lifter.

Progressing strength and power training

Training Principles	Stages of Development			
	Players U17	17+ or Novice	Intermediate	Advanced
Type of Training	<ul style="list-style-type: none"> - Body weight resistance. - Circuit training. - Technical development of lifting with free weights and machines. 	<ul style="list-style-type: none"> - Body weight resistance. - Circuit training. - Progressive overload with external resistance. - Technical development of lifting with free weights and power lifts. 	<ul style="list-style-type: none"> - Hypertrophy and strength training cycles. - Power training cycles. - Multi-joint exercise should make up the bulk of the training and some instability progressions should be gradually developed. - Power lifts should be incorporated into training following technical competency and development of strength base. - Plyometric training should be introduced with the aim to learn competency in its execution. 	<ul style="list-style-type: none"> - Training should be highly functional and specific to individual needs. - Maximal power and strength should be developed through well-planned training cycles. - Power lifts should be well learnt. - Plyometric and complex training should form a part of this programme which, due to the player's competency and fitness levels, can be highly demanding and varied. - Resistance training with instability should be used regularly.
Frequency of Training	1-3 (max) sessions/week	2-3 sessions/week	2-4 sessions/week	3-4 sessions/week
Volume of Training	6-8 exercises (including core & abdominal) with 12-15 repetitions performing 2-3 sets.	6-10 exercises (including core & abdominal) with 8-15 repetitions performing 2-3 sets.	6-8 exercises (including core & abdominal) with 4-8 repetitions performing 2-3 sets.	1 or 2 power lifting exercises of 1-6 repetitions performing 3-5 sets. 4 or 5 other exercises (including core and abdominal) with 4-8 repetitions performing 2-3 sets.
Intensity of Training	Body weight or light weights to develop muscular endurance.	Moderate resistance using the principle of progressive overload.	High resistance with 4-8 repetitions using the principle of progressive overload for strength development. Power lifts should be of moderate resistance, higher repetitions (6) and follow the principle of progressive overload as appropriate.	High to maximal resistance dependent upon the different cycles of the training programme (1-6 repetitions).

Periodised Year	The type of training will remain fairly constant but frequency should reflect playing demands and be reduced accordingly.	The intensity of training has increased to meet the new training aims. The training programme will begin to reflect this and follow the structure of the single periodisation more closely.	Programmed cycles (of approx 6 weeks) of training to develop strength and power need to be structured into the playing year.	Training should be highly structured following the principles of periodisation in order to obtain maximum gains.
	Training should take into account the stage of the playing year. As a rule the amount of time dedicated to strength and power training is greatest in the off and pre-season and the volume is reduced during the season due to playing commitments.			
LTAD	Training needs to take into account the demands of school, social and emotional needs as well as physical development. The aim is to develop sound technique and basic strength gains. Players whose physical development is in advance of their chronological age may progress to external resistance training if appropriate.	The physical development of younger players needs to be closely monitored to ensure they are ready for the increase in the intensity of weight training.	Players should have developed a sound strength base to allow them to begin power-based training. Technical competency should be high across a large number of lifts, as should their knowledge of training.	Players are now well-developed power athletes who possess a very high degree of technical skill and knowledge.

Progress to the next stage should only occur when the player is physically, technically and mentally ready. Time spent at a stage should not be used to determine readiness for progression.

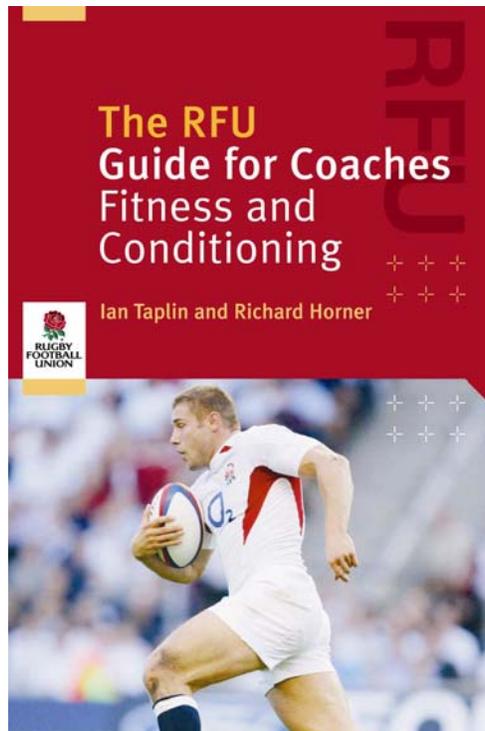
The table above should provide you with a basic guide in terms of the principles of programme design and progression. All training plans need to be individually tailored and designed by a qualified trainer.

Summary

Improvements in strength and power will have major benefits in terms of speed, jumping, winning collisions and the general physicality required for rugby. If correctly implemented, it will also have a positive influence on injury prevention.

Safety is the key when performing strength training. Provided that the basic guidelines are followed, with a gradual and appropriate progression, then all players can undertake this form of training. Significant improvements in strength and power will not occur

overnight and a structured and long-term programme is required to produce lasting results.



The book is published by A&C Black Publishers Ltd. and is on sale at bookshops at a price of £14.99. It can also be ordered direct by calling 01256 302688 or visit www.acblack.com to order with a 10% reduction.

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