

RECOVERY: A MEAN OF TRAINING



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The figure of the coach is profoundly changed in recent years with the massive intervention of the scientific support of which cannot be taken into account and that constantly opens new perspectives and new methodologies.

Of course, it is not recommended that you allow yourself to be overwhelmed by the ongoing proposals for innovative tools and techniques that should be experienced in a reasonable time prior to verifying the goodness and effectiveness, but it is equally wrong to expect to remain anchored to their own ideas without looking around with the critical attitude toward a new solicitations that gradually emerge.

It seems to me to be shareable, for example, the observation on the real danger of an imbalance between the specific physical preparation and special physical preparation, with a wide use of the first to the detriment of the second.

It happens very often to have recourse to forms of work that has little to do with the gesture or technical with the evolutions tactics that the player will be concretely to face during the game. The cue more interesting inserted in this thesis seems to me to be able to say both focus on the function of the central nervous system , in relation to the technical preparation and physical of a handball player.

Therefore, there is a close correlation between ability sense perceptual and motor performance. If this is scientifically proven to any individual, since it is known that the brain is the unit that go impulses to the muscles and then the movements, in relation to the environment that determines, even more, this also happens to the player of handball or for any athlete. It then follows the need that coach in addition to treating physical preparation, such as support of technical skill, tactical should also aim to give their athletes a mobility strategy appropriate to the context of sport which will be practiced.

A player of handball for example, should move in a correct way in both form and organization time - space in relation to the ball, to teammates and opponents. The player of handball must possess, then, not only physical abilities and technical/tactics, but also of reactivity to the nervous impulse; this will make it able to offer an immediate response to all the problems that the various game situations involve, getting used to choose the best solution. It is clear that the task of the coach becomes more complex and articulated and his work will not need to have the support of a team. By accepting these reflections the trainer will no longer be limited to organize the external load only with the simple stroke, but will investigate a series of exercises in special physical preparation that are as close as possible at the time of the game.

As a result of a statistical control on activity in the preparation phase pre championship and championship from players of handball I have found that the programming, as regards the amount of the load, foresaw a percentage breakdown between the specific physical preparation (**P. F. Sca.**) and the special physical preparation (**P. F. Sle**) a net disadvantage of the latter. The investigation therefore indicates, that coaches have a tendency to pursue the development of strength, and especially of the resistance, by proposing an activity (**P. F. Sca.**) that in exhibition form has very little to do with the gesture or technical performances or tactics of the discipline practiced .

And then is underrated, in the sense of time dedicated, the special physical preparation, which is by definition corresponding to exercises whose structure biomechanics is identical to that which the player performs during the game, and at the same time, pursues the development of one or more quality athletic physical. It includes all those training modes through which must be sought as the technical refinement, with and without ball, as the synchronism tactical and determines, with the appropriate methods of execution, the increase of strength and the resistance of muscle fibers that the athlete actually use in the game.

The organization of the special training must take into account then, both of the principles through which it teaches both the technique and tactics and as for those that indicate the ways in which it is possible to increase the physical qualities. All of the capabilities that the player must possess does not depend of course only by the structural characteristics and biochemical of the muscle, but also by how the nervous system has been "arranged", through the training, to ensure that the muscles themselves behave in a certain manner. Normally is not given the due importance to neuromotor aspect of the workout, while we believe it to be of fundamental importance, especially during the conduct of a tutorial of physical preparation special.

The workout and the central role of the nervous system

The brain, principal component of the nervous system, possesses characteristics and potential genetically predetermined, and uses for "reporting" with the world that surrounds, the system muscle bone. All this becomes operative by an organic and biochemical whole that throughout life provides the energy necessary for life itself is maintained, and allows the man, more precisely in his brain, to express their full potential.

In this respect the muscles, bones, articular structures, should be considered as the means by which the brain uses to satisfy its own needs. During the game the athlete, urged by his senses, thanks to the genetic characteristics, knowledge and experience gained through training constituted the intentionality to pursue a goal. The player, immersed in the reality of the game or in the workout, perceives that must find a solution to a problem that the game itself proposes. Immediately, and autonomously are activated nerve connections more suitable, in that moment, to solve the problem. The athlete can thus, for example, throw, carry out a step or move in the field to receive in turn the ball or to perform other actions. All of this, with techniques and tactics, suggested by the game situation that is occurring in that moment.

The quality of game that the athlete expresses therefore depends on either by its genetic potential that the training carried out previously, which must have been very focused and detailed in order to enable the potential to flourish practically. In brief, we realizes this dynamic: **NEED** - perception and recognition of the objective, **COMPETENCE** - the workout affects the nervous system to implement the more useful functional connections, **FUNCTIONAL PERFORMANCE** - the workout affects the muscles that can be pursued the goal.

In spite of all the best of intentions, as is often the case, the athlete, for example, can make a wrong choice of the moment or the type of passage because pressed from an opponent, or it can pass to a teammate that, within the scope of the offensive strategy is not useful to achieve the intended objective.

Learning technical tactical are perfectly playable only in theoretical terms, in fact provide a stability of athletic performance which is not always fully satisfactory; in particular when it comes to sports games where the behavior of the opponent is always conditioner and the brain is not able to supply answers preordered. The brain, when stressed, answers always to the best of its ability in the information that come in that moment from the environment, in spite of this such behavior, by the coach, can be considered a failure.

Taking into account the fact that every time that the brain enters into action produces the best operational strategy, this is always the most suitable to meet the needs that the environment in that instant proposes.

As said previously, it may be adversely affected(in a sporty way) both from the incorrect interpretation of the information, to inability of the athlete to decode it and also sometimes the merits of the opponent (fakes), and even by a limited availability mobility due to insufficient specialization.

More often the behavior of a high-level athlete and trained, that provides answers technically wrong, must be interpreted as a more or less inadequate activation of proprioceptive sense/perception of the nervous system. The motor response, therefore, in this case does not depend on the brain, i.e. by the part that exercises the muscles, but the positive resolution errors tactical/technical should be sought in the brain perceptual, that is in those nerve structures that allow the athlete to "read" the environment.

In this capacity for reading, to which belong the cognitive processes (attention, perception, memory) are responsible the athlete himself with his availability and participation but in equal measure, with their proposals, even the coach and the athletic trainer. For this reason the tutorials must be chosen with great care, so that the athlete has the opportunity to develop these abilities, which are so important to elevate the level of performance. However, it is also true, that some workouts, owing to various circumstances, often not linked directly to the sports activity, are not profitable, because during the exercises are not created by the technical the conditions that are activated in the optimum manner perceptual processes.

This latter situation is particularly serious if it lasts in time, in so far as the overall performance of the athlete can do no more that tend to drop considerably. This point requires the formation of a hypothesis, and consequently of a practical proposal.

Having already said that the brain can express a concept only through the motor tasks, we can say that all forms of expression have a substrate neuro motorial. To express a need, or generically for reporting, the brain uses specific muscles that determine from time to time for example, the word, the handwriting, drawing, or any other expressive form of motor activity. So we can say that, by analyzing the phenomenon from the part of the nervous system, is wrong to restrict the motorial adjectivation only to those activities related to the practice of physical education and sport.

This statement cannot to find easily an application with regard to the motor activity, indeed into common use; when you want to acquire to an individual a specific gestures (technical ability) there is a tendency to propose as corollary of major exercises, a multiplicity of activities which are general and aspecific, with the vain hope that encourage learning.

This behavior on the part of the sports operators find justification in the fact that in this way you intend to give to the nervous system the opportunity to be more "plastic" in determining a motor response.

You ignore in this way, that for plasticity we refers to the predisposition to be able to learn an infinity of different specific teachings. They will become then steadily reproducible and , therefore, the athlete will acquire richness of behavior, only by pursuing during the workout a stereotyped activity, for each of the learning that wishes to achieve.

Therefore to learn any type of technique are necessary repeated and specific exercises. We can say then that the circular system, represented by the narrow functional relationship to the cerebral cortex, under cortical nucleus (who will manage the automatisms), and the peripheral structures muscle-bone-articular that allow actually to pursue a goal, is fed, supported and developed only from practical activities used to achieve the same objective.

This last statement must make us think about, all the coaches that, during the game, pretend a behavior technical or tactical from their athletes, which they often cannot provide because in workout was not sufficiently stabilized or even ever tried but only suggested verbally.

The proposed operating from a practical point of view being, the first objective of each coach to reach to their players, whatever their level of performance, a sufficient gradient of technical skill, must necessarily be linked to the development of the strength, necessary for this to happen.

The next training step is represented by being able that athletes may express at that level for the duration of the game.

Ultimately shows up a problem related to its ability to resist. During your workout, to be safe enough to involve the muscle fibers actually used in the game, thanks to the synchronism of specific motor plaque, you must pursue the best sports form by synthesizing in the same tutorial the technical activities tactic with the athletic physical (**P. F. Sle**).

For this purpose for what regards the strength, high tensions which may be obtained from the use of the overloads, are impossible to achieve during a technical activity. It is good therefore look for the development of the strength with tutorials classics of weights by choosing preferably those that lead to high tensions in fast fibers, to avoid unwanted increases in muscle mass.

However, remains very low correlation between movements classics of weight lifting and technical gestures characterizing the sports games.

Also to improve the resistance remains a similar problem. Only training with the same tension and in the gestural form that the discipline provides, it becomes really resistant and therefore capable of lasting for the times provided by the holding of the game. This means that it is preferable to propose exercises with or without ball that endure even a few minutes and repeated several times, but in which the athletes move with gestures quite similar to the movements of the game, rather than running the classic "distances" repeated around the field, using the running technique derived from athletics.

The proposed practice, then, can be summed up in suggesting the coaches for what concerns the development of the various aspects of the resistance and to minimize the run on line and at a steady pace, and adopt a method of working more rich of variants and variables, what is expected for the exercises in special physical preparation.

On the contrary, for what concerns the methods of development of the strength it can be stated that for need, such as a low level of maximum dynamic strength, or a muscle imbalance, it is possible to forecast the use of means of workout derived from exercises in aspecific physical preparation.

At this point it is appropriate to establish what it means training load, whereas even that usually means the outer which corresponds to the mode with which is organised a workout. This mode takes into account the dynamic equilibrium of some parameters that will be enumerated them shortly. The external load to be effective, must determine organic systems and neuro muscular stimulation enough for this to occur in the athlete with an increase in their prestative capacity, the so-called internal load.

The parameters which determine the external load of training are:

- **The quality**: underlying the muscle groups committed to perform a given gesture
- **The quantity** : is determined by the number of repetitions, and the series, from meters run in the context of a cyclic activity, or the duration of an exercise
- **The intensity** : normally is expressed as a percentage relative to the maximum capacity
- **The density** : is the ratio between the time used to perform a series of tutorials, and the total of the workout, including then, the recovery between a serie and teh other or a repetition and the other

At the moment in which the technique and tactics become decisive for the purposes of the perfromance, the intensity of a tworkout, as parameter of the external load, loses significance. Since it has no sense quantized in percentage terms the goodness of a gesture or a collaboration tactics.

In any case, it is true that there is in need to be able to handle the load and the relative influence on the performance.

This puts the need of its determination that, given the conditions, must be made on the basis of a different parameter from the intensity. This parameter may be linked to an operational mode that takes the mental effort that the athlete must make when he trains and stands out with the desire to act involving better capabilities. So as not to create misunderstandings and better distinguish the concept of maximum intensity (muscle parameter) from that of maximum commitment (brain parameter).

For example if after playing moments particularly demanding, will result to be too long the needed energy recovery time, to allow the optimal functionality of the sense/perceptive system, the player, or better his brain, may be inducted to mistakes, responding with a not appropriate motor activity and not in line with the needs of the game.

During the exercises in technical/tactical preparation and special physical preparation you can maintain a constant and high the mental effort, also organizing the external load with ease because you can program the sessions by modulating only the amount of work.

In fact, in this case the quantity appears to be directly proportional to the impact of the specific stimulus, both on the nervous system and on the muscle one.

In summary if the commitment is optimal, the greater or less duration of the work, that the athlete is able to play with positive performance, it is also significant to a more or less high state of form. In handball for example is an easy reference to the training of the goalkeeper and the court player, where to the latter are normally made concessions in terms of precision, while to the goalkeeper is not granted to have the minimum uncertainty: "The player can, the goalkeeper should not take the wrong".

The "can" and the "not have to", behaviors that are born and are unconsciously accepted by athletes together with the choice of their respective roles, are significant of the different efforts during your workouts, and justify to me, the more stability at higher levels of efficiency that is found in goalkeepers.

Last question before facing more concretely the problem of the recovery, is the question of how it is possible to keep high the commitment if, as you establish motorial automated processes, these are performed without conscious control and then with consuming less nerve energies?

However, given that the starting assumption is that to recover quickly the energies must be "expended copiously", during the technical session you need to create the methodological presuppositions for which it is avoided to the athletes a customary behavior. This can be obtained by inserting methodically, in training program, new or little known technical aspects, or proposing known exercises combined with elements of disturbance that determine greater constructional difficulties.

The all remembering that, in every activity, must be fixed rigid aims to be pursued without error, that determine in the athlete the fear of making a mistake, because it is precisely this important emotional aspect that can push to express with a higher degree of psychophysical commitment.

In practice, the athlete in conditions of full physical/technical form puts in place an operation mode that is visual-motor (sees and immediately responds) that allows lower expenditure of energy and highest performance.

Are in fact the muscle fibers, not the muscle in its entirety, to be organized in an ideal relationship space/time, so that the gesture is modulated in the best way possible. If everything that we are going to do with the word handball or any sports game (technique and tactics with or without ball, commitment and intensity) we call it "**technical siamese twin**", and everything that is not especially handball (athletic preparation specific and general or other) we denote as "**athletic siamese twin**", we can depict a player as two conjoined siamese twins, partially matching and coincident, with some features in common but substantially separated.

Every muscle appears as part of the twin technician who plays handball and a bit of twin athletic that runs, jumps, lift weights etc. It is evident that whereas the hypothesis that indicates them as siamese, they have overlapping functions for which we can say that the twin that runs and jumps is functionally related to the twin that plays.

Precisely because, when we talk of means used to physical preparation, it affirms that there is a certain correlation with the gesture of the game we can say that only a part of the functionality of a twin influence the other. From which it derives that the twin technical and athletic are two entities substantially distinct.

The impression on current developments in physical preparation and that should be given more importance to athletic twin : in practice to those muscle fibers that are only partially used to play handball, and of which we still has not been clarified completely how much strength and resistance they need so that the efficiency during the game is better.

It follows that the physical preparation is a sort of dress that should be worn over the technique and tactics, for which very close must be collaboration between coach and physical preparator who must operate also as if they were conjoined twins, where one takes care of the technique and tactics , the other the physical preparations, possessing both some knowledge in common.

As we have seen there is a scale of possibilities of intervention by the muscle fibers.

The muscle, therefore, guided and supported from the nervous system, may cover a broad range of possibilities contractile, ranging from a task extremely different, body building, to other perfectly equal (technic) to those that occur during the game.

I think that with subjects not yet established technically or in age where it is important to search for the harmonious development of the body, the methods of atrophic increasing as those of coordination nonspecific, can be applied.

It is necessary to take into account, however, that the risk of injury is high, to the accentuated desync that similar exercises determine between the muscles agonists and antagonists. For the same reason, the coach must expect for long periods a deterioration of the technical capacity and as a result of the overall performance. And for players of high qualification , taken for granted that they are in possession of technical qualities more than enough, I think it is convenient to deal directly wit specific coordination drills. This will lead to an immediate rise in the technical performance through the same modes for which is called a true neuromotor learning.

This learning must be targeted to improve the capacity of arts to extend with great skill.

These drills suitable for developing neuromotor coordination must be reamed not too long before the match to maintain the heritage of skills acquired.

In addition, if a short intense muscular effort is separated from the other by a large recovery, the exercise will be exploited only in a positive sense (better coordination) and will have removed the risks of negative influences that determine a consequent decrease in the performance. A training session determines two effects:

- **The immediate effect:** translates into disorders represented by a fatigue and muscle pain generalized fading into a few days with a different mode depending on the speed of contraction with which was performed the workout. The pain reaches the apex within 48 h following the workout with a intensity five times higher for the eccentric work than the concentric;
- **The delayed effect:** if the muscular work was such as to bring deep disorders in contractile structure the athlete needs a very long period in order to receive the positive outcome of the workout. In an eccentric cycle is achieved effectiveness from six to ten weeks after its conclusion; in an isometric cycle the regeneration of the fibers is from four to six weeks; in a pliometric cycle you must perform the exercises at least 10 days before the race.

The reference model is a physical/athletic model, and that is a player that can propose his skills all the times that the needs of the game require it, so for a large number of times and with intervals of recovery that are for the shorter.

This model is related to the acquisition of a quality that may define passive resistance. In order to clarify the concept we can locate an athlete who is preparing for a competition by programming and periodizing his work on improving strength and endurance that will allow the user to make the best in a run, moment which represents the active phase of an agonistic performance.

On the other hand, if we are formulating a hypothesis for which, in a competition the athlete must participate in subsequent tests separated by a recovery of a few minutes, instead of hours or days, is inevitable that becomes crucial the temporal distance between a run and the other, a period that corresponds to the passive phase of this unreal performance.

The question to give a solution is if the means of training that allow the athlete to improve the active phase, are equally useful to determine the improvement of the passive resistance, and that is the ability to retrieve the psychophysical energies after many repeated efforts.

The answer is fundamental in a intermittent activity such as that which characterizes the sports games, causing a need to understand what means of training affect to a greater extent the ability to recover.

During a game of handball, as well as in all the sports games, there are many actions (active phases) separated by equally numerous and brief moments of recovery (passive phases), in which the optimum ability to restore the energy spent in previous action is directly related to the performance of the next action.

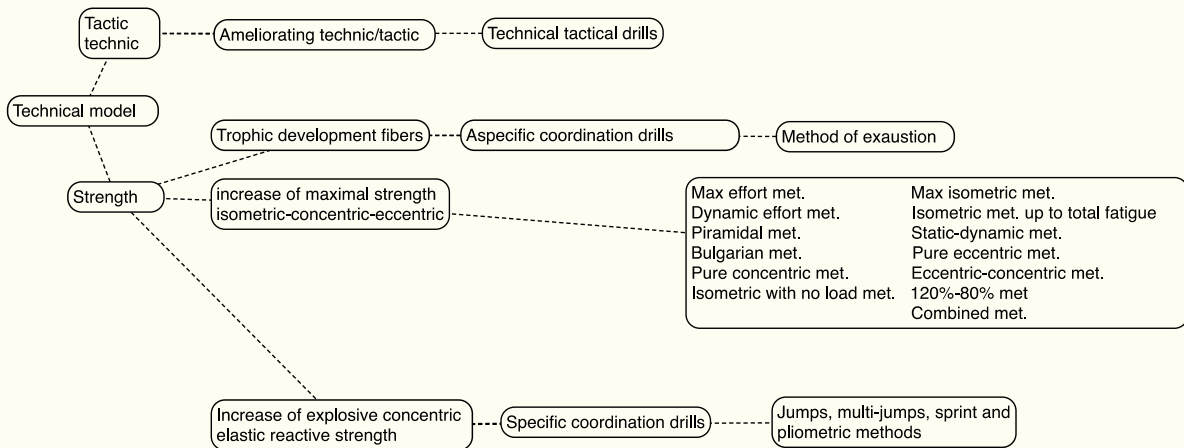
For example, if at a certain point in the game a player is no longer able to do some movements with the effectiveness that the coach would expect; this is done, according to this hypothesis, not because the athlete is unable to perform the action technique or the tactical movement that has taken up a short time before, but because the cost of the previous activities was too high and the recovery time between them is no longer sufficient to meet the needs of the game.

If we can see our player within these terms and, to improve performance, consider as a priority to increase the ability to retrieve an effort carried out previously, you might want to consider if the application of some of the means of training currently put into operative is more or less justified.

It doesn't end here, however, the analysis of the needs of recovery but there is also the need to recover and to combat the fatigue due, day after day, from training sessions and the number of matches that will succeed in the course of the competitive period, doing in such a way that the psycho-physical recovery may be completed at most within 24 hours of commitment.

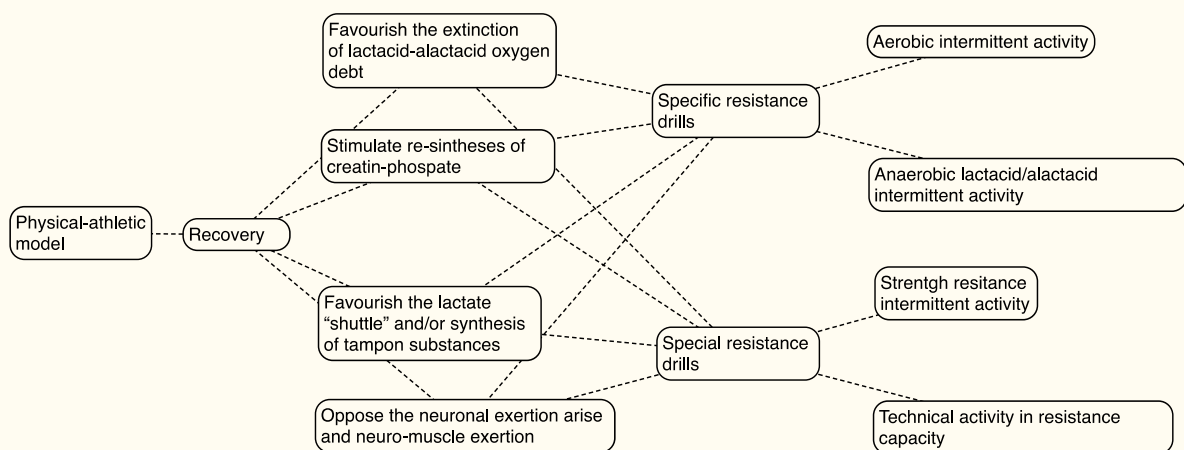
Below I will try to find a system for a proper structuring of means which are contained in training session so as to be able to influence positively the mechanisms neuro-humoral to be able to quickly restore the standard athletic physical condition.

Goals Training mode Means and methods



TRAINING MODES TO ACHIEVE THE TECHNICAL REFERENCE MODEL

Phisyological goals Training mode Means and methods



TRAINING MODES TO ACHIEVE THE PHISYCAL-ATHLETIC REFERENCE MODEL

Orient the training toward the improvement of the capacity of recovery means take account of how it enhances the organism:

- **the mechanism aerobic:** to pay the alactacid and lactic acid debt
- **the mechanism of resynthesis of creatine phosphate**
- **the metabolic action of the so-called shuttle of lactate** (DI PRAMPERO argues that if the amount of pyruvate formed from glycogen is greater than that oxidized in the Krebs cycle, the fiber is in anaerobic conditions, the condition is then defined ipoaerobic) other condition is if the muscular fiber assumes lactic acid from the extra cellular space and oxidizes with carbon dioxide and water without consumption of glycogen. This type of fiber is defined iperaerobic.

The temptation is to identify the first with those fast and the second with those slow. The aerobic threshold then becomes the exercise intensity below which all, or almost all, the fibers in action are under aerobic conditions.

The excitations of athletic training, oriented toward the increase in the capacity of recovery must pursue the stated objective.

Using exercises organized in such a way that the distances, the intensity and the recoveries entail the production of lactic acid in fast fibers, but also its rapid disposal especially, through the slow fibers.

In other words the objectives to be followed are respectively:

- 1 The increase in recovery ability in mixed system anaerobic-aerobic
- 2 The increase in recovery ability under anaerobic-alactacid
3. The increase in recovery ability in mixed system anaerobic-alactacid and lactic acid.

It follows a sequence of exercises:

- 1 Exercises of specific resistance mixed aerobic-anaerobic
- 2 Exercises of special resistance mixed aerobic-anaerobic
3. Exercises of specific resistance alactacid
4. Exercise specific resistance mixed alactacid-lactic acid
5. Exercises special resistance mixed alactacid-lactic acid

All the means of training used in a session must have a history that begins in prechampionship period and ends at the end of the league itself, this means that the coach must set and follow a programming articulated in the times and in different ways.

Then must be cyclically proposed during the period preagonistic and agonistic, considering in the scope of the exercises itself, a progressive increase of the external training load, updating in time the methods with which is being proposed.

For cyclicity is meant the repetitiveness in the time of exercises with defined goals or even more extensive with reference to the variability of the entity of training load that concludes his small cycle every week.

In all of this must be considered that the stabilization derived from the adaptation, which leads to a process of inevitable "detraining" losing the skills acquired previously, this is not the final step of the process of acquiring the status of an agonistic form but on the contrary represents the initial stage of its decrement.

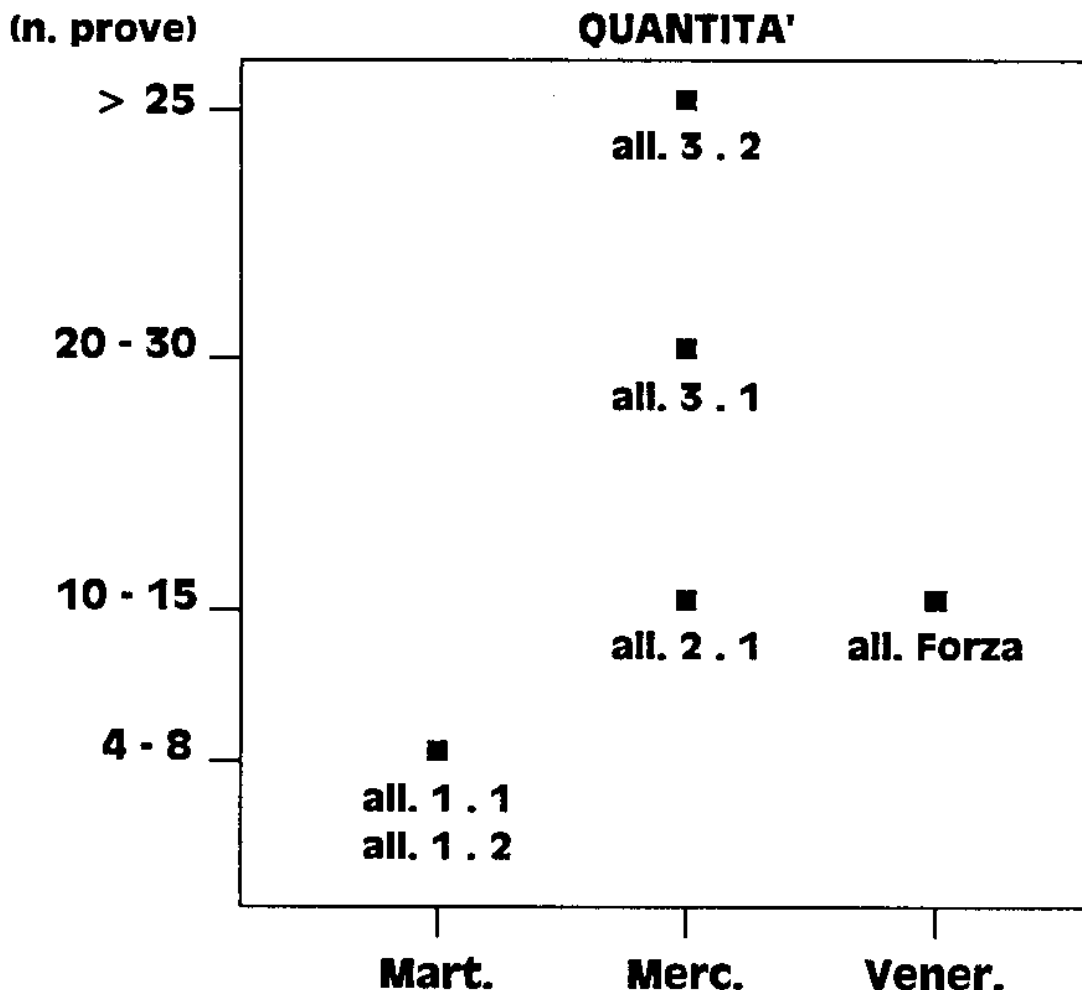
In addition to the size of the load and to the muscular tension you must take account of a further variable: the recovery time between the individual repeats and/or between the various series.

The recovery time between exercises clearly affects the ability of recovery of the athlete, parameter this last, as I have endeavored to support, I think decisive in influencing the agonistic performance in a sports game. In so saying, the recovery time (decided by coach) for the various exercises, must be proportional to the capacity of current recovery athlete (neurophysiological adaptations put in place by the organism).

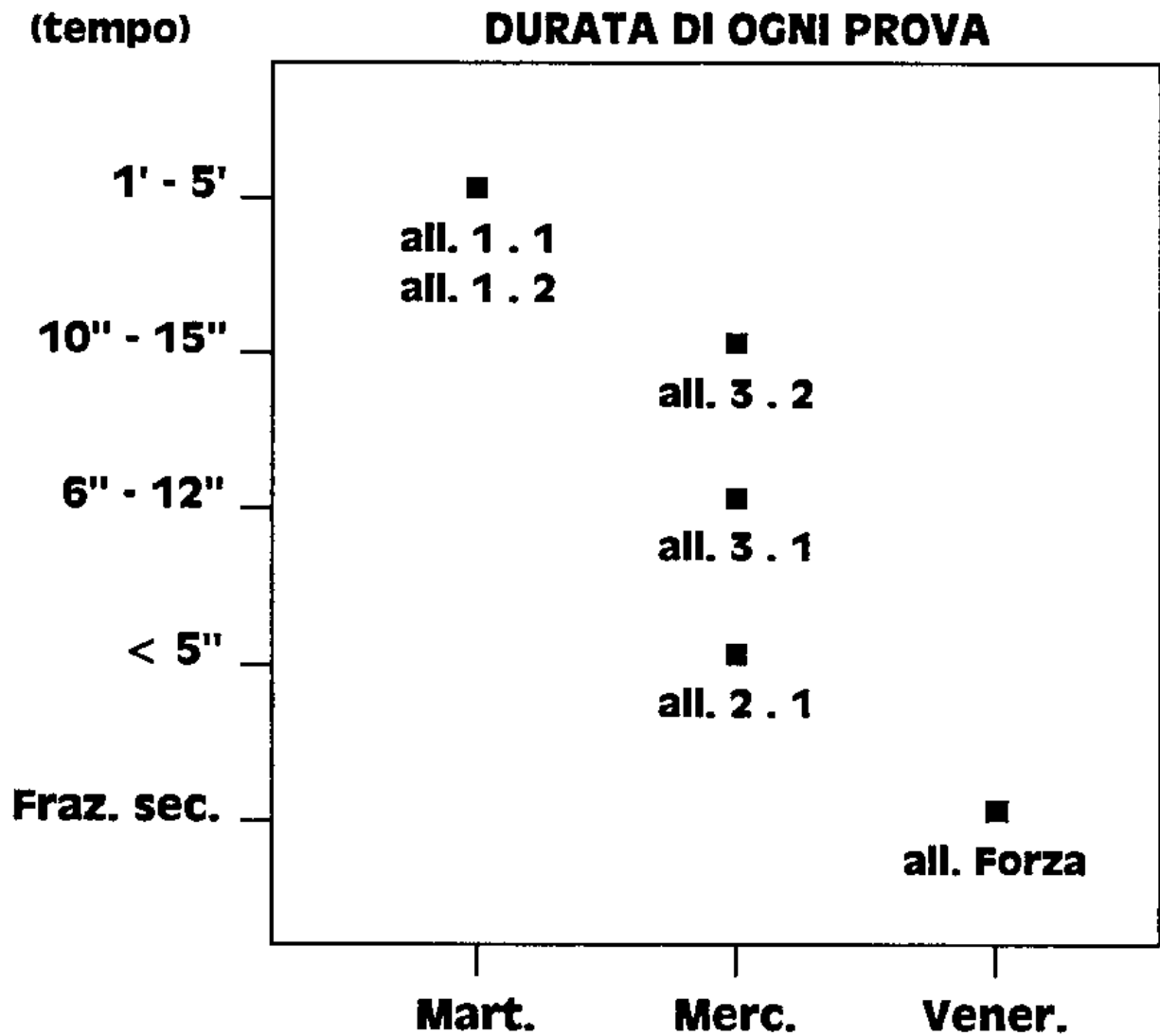
If the payback period, for example are too short , you may determine a significant muscle acidosis, and with this a situation of not specific workout, given that the paradigm from which we started is to promote the disposal and not the accumulation of lactate, which limits the ability to realize the technical/tactical tasks in an optimum manner.

For the practical use of the information here acquired are listed below, the tutorials in physical preparation provided on three sessions a week, which I believe will provide a constructive contribution to the implementation of the objectives in this thesis

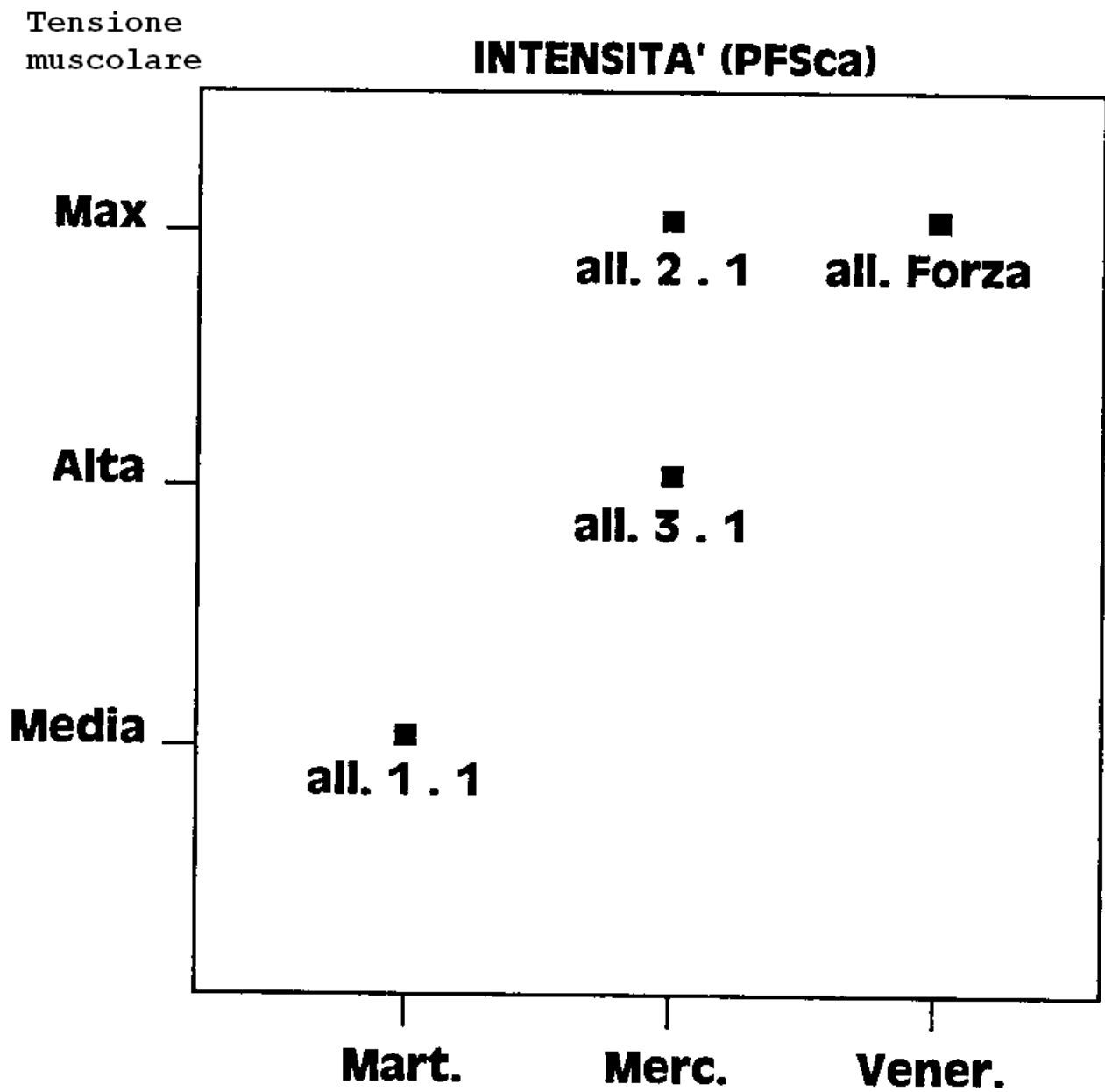
The organization of the session weekly (on the basis of a work unit of four weeks in championship period), follows a logic related to the theory of the principle of external load of workout.



On the vertical axis indicates the number of tests (quantity) for each type of workout developed in weekly meetings (horizontal axis) on Tuesday, Wednesday and Friday

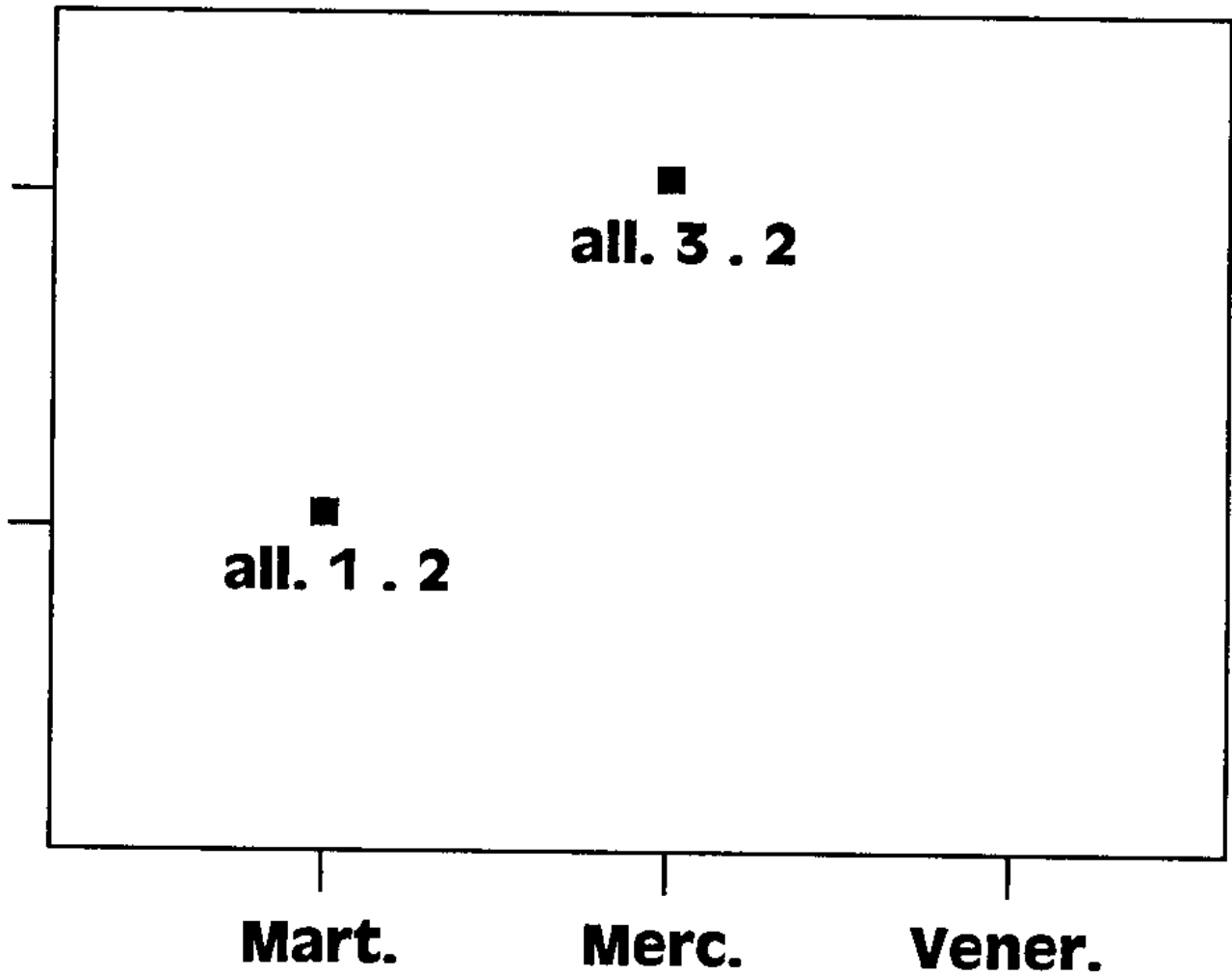


In this diagram is shown the duration of each test

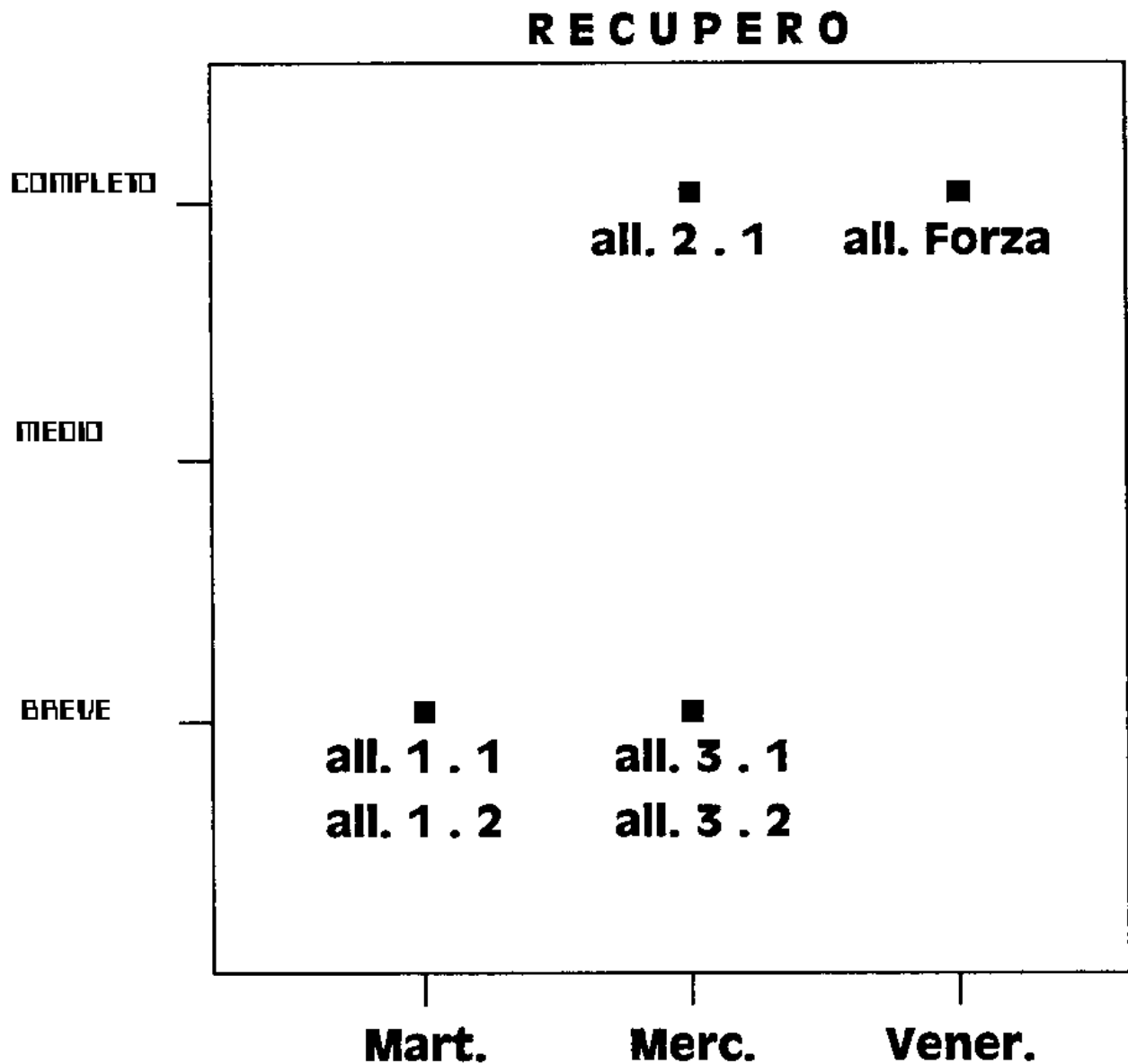


In this scheme, on the other hand, indicates the intensity understood as muscular parameter applies to the PFScA

IMPEGNO (PFSIe)



In this fourth scheme is indicated the commitment , understood as cerebral parameter , valid for the PFSIe



In the latter diagram i have shown the variable of the recovery between the tests and/or the series. Thanks to these graphs, with a sufficient approximation, you can learn about the type of exercise developed in every single day of the week, in which the sitting is dedicated primarily to physical preparation- athletics. It is also possible, identify, for each type, which are the variables of the training load that characterize them.

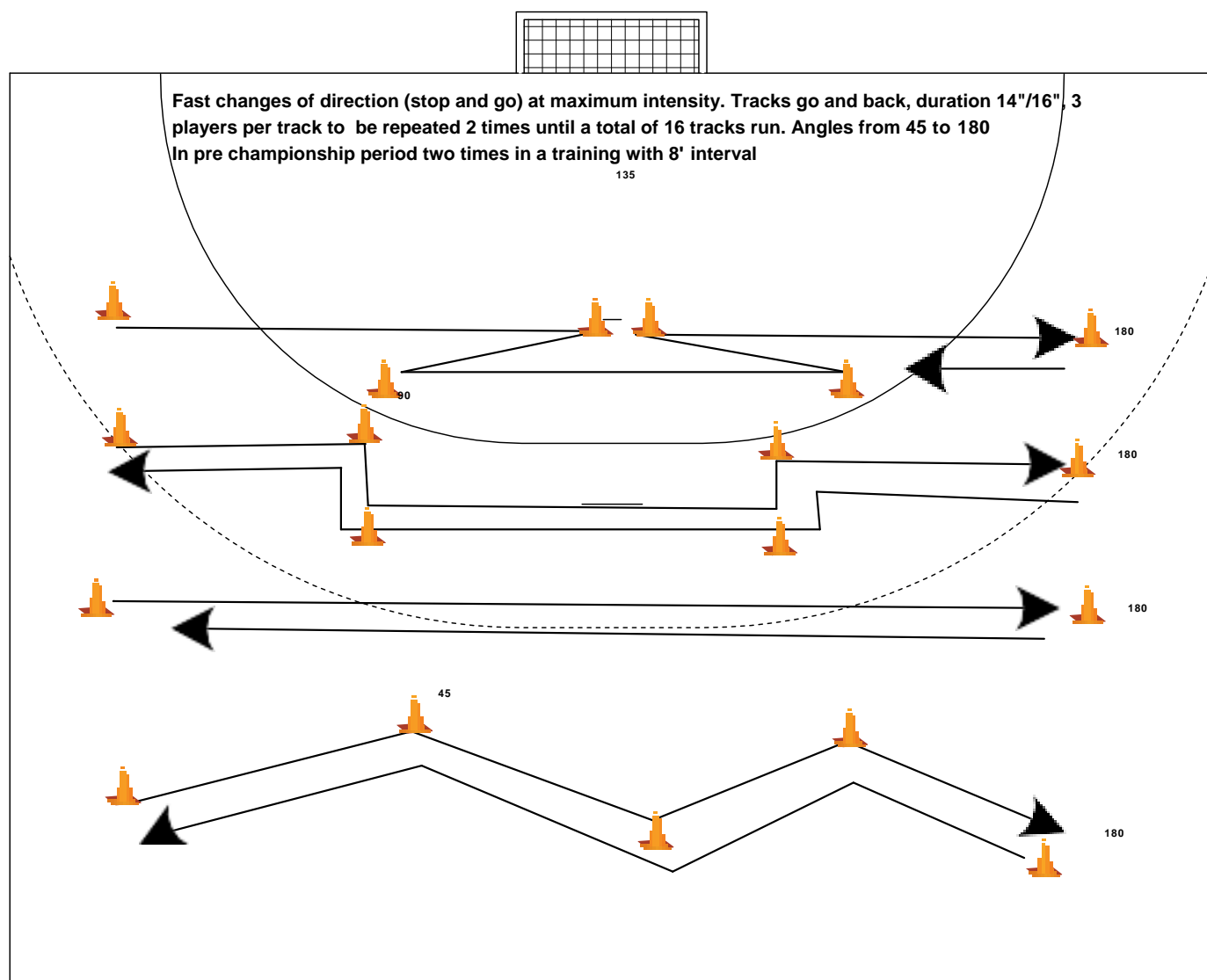
Alatacid debt explained

After a consideration about the movements, with or without ball, that the players usually execute during a match, a series of exercitations were developed in order to propose in a training the majority of motoric possibility of the athlete himself

The priority in the training of a handball player physical skills is supposed to be given to the "special activity to resistance to strength" : special as it is overlapping that kind of preparation in which you look for the technical skills improving meantime the physical-athletic performance, strength activity because the movement that you make at any change of direction correspond to an eccentric semi bending of lower articulation followed by a following fast extension at maximum intensity that is an expression of explosive strength, resistance activity because are foreseen various repetitions of change of direction in a track with recovery time that goes between 40" and 20" depending in the period (pre-championship, championship).

It goes without saying that to maintain a high intensity during the numerous repetitions, we need to speak about the increase of recovery possibilities, and , at the end, about increased resistance capacities.

Here below some examples:



The evaluation of the work and the related evaluation of physical skill improvement, comes through a test explained below:

- After adequate warming up the athlete will run 40 mt shuttle run (may be from the center line of the court to the post of the goal) for three times with a total recovery (few minutes) between one run and the other, the best time out of three will be recorded and will establish as **T1**
- The day after the athlete will run same distance (40 mt in shuttle run) for 6 times with a recovery of 20" between the runs, at the end of test the highest time of the 6 run must be recorded and will be established as **T2**
- With the following formula you may calculate the decrease index in percentage :

$$[(T2 - T1) : T1] \times 100$$

- Therefore examining the result if you can have the following evaluation
 1. From 0 to 2% = optimal
 2. From 2 to 4% = average
 3. From 4 to 6% / = sufficient recovery
 4. Over 6% = insufficient recovery

Parallel to this work in the hall an outdoor work is convenient to improve this skill, the kind of run proposed is free in the space as it determinate only by the time of the run and by the intensity, the time may be variable form 3' to 5' the intensity instead must be medium, high medium, high following the below indicated table:

- **6 times (15" medium, 10" high medium, 5" high)**
- **6 times (10" medium, 12" high medium, 8" high)**
- **9 times (8" medium, 8" high medium, 4" high)**

The signal for change of intensity may be given with a whistle by the coach.

Finally the last exercise that may be alternate in the hall and should be taken minimum one time per week consists in 4x40 run shuttle system (from the goal line of one side to the goal line on the other side, with 6 to 9 repetitions and with an interval between the run of 2'30". The groups (maximum three) will be divided taken in consideration the **T1** of our shuttle run test, and therefore the run time should be between 28" and 32" , the intensity must be regular and the time of the run must always be the same; what will change when the coach realize an improvement of performances in time reducing the interval until 1'30" or changing the number of repetitions between 6 and 9 as said before.



BIBLIOGRAPHY

E. ARCELLI – Che cos'è l'allenamento – ed. Sperling & Kupfer Milano 1990

E:ARCELLI, F.FERRETTI – Calcio preparazione atletica – ed. Correre Milano 1993

P.O.ASTRAND, K.RODAHL – Fisiologia - ed. Ermes Milano 1984

AUTORI VARI – Fisiologia dell'uomo – ed. Ermes Milano 1987

C.BOSCO – Elasticità muscolare e forza esplosiva nelle attività fisico-sportive – ed.. SSS Roma 1985

C.BOSCO – L'effetto del pre-stiramento sul comportamento del muscolo scheletrico e considerazioni fisiologiche sulla forza esplosiva – ed. Centro Studi e Ricerche della FIDAL Roma 1985

C. BOSCO – Aspetti fisiologici della preparazione fisica del calciatore – ed. SSS Roma 1990

C.BOSCO , P:H: LUHTANEN – Fisiologia e biomeccanica applicata al calcio – ed. SSS Roma 1990

F.E.BLOOM , A.LAZERSON – Il cervello, la mente, il comportamento – ed. Ciba Geigy 1990

R.CAPANNA , E:BIGNARDI – La forza.Come e perché negli sport di gruppo – ed. ECIG – Genova 1985

R.CAPANNA , E:BIGNARDI – Non solo muscoli. I processi cognitivi nello sport – ed. Nuova Phromos - Città di Castello 1990

R.CAPANNA, E.BIGNARDI – I muscoli al servizio di sua maestà il cervello – La resistenza e la forza – ed. Nuova Phromos Città di Castello 1991

G.CAVAGNA – Aspetti di biomeccanica – ed. Libreria Cortina Milano 1978

P.CERRETELLI – Manuale di fisiologia dello sport e del lavoro muscolare – ed. Universo Roma 1985

- A.DAL MONTE – La valutazione funzionale dell’atleta – ed. Sansoni Firenze 1983
- E.L.FOX – Fisiologia dello sport – ed. Grasso Bologna 1982
- R.CAPANNA – Il recupero, l’altra faccia della medaglia – ed. Nuova Phromos 1996
- C.GARULLI – Supporto atletico alla tecnica del calcio – ed. Re Enzo Bologna 1993
- E.FASCETTI , R. SASSI – Un metodo per la programmazione nel gioco del calcio –
ed. Nuova Phromos Città di Castello 1989
- R.MARGARIA – Fisiologia muscolare e meccanica del movimento – ed. Mondadori
Milano 1975
- P.V.KARPOVICH – Fisiologia della attività muscolare – ed. Scientifiche Leonardo
Roma 1967
- P.E.DI PRAMPERO – L’energetica dei giochi di squadra – ed. Marathon Service
- R.CAPANNA,G.PIASTRA,G.MENICHETTI,P:GRECO – Valutazione della forza
esplosiva della muscolatura estensoria degli arti inferiori
– Atti XV Congresso Nazionale di Medicina dello Sport
Cagliari 1988
- B.TABACHNIK,R.BRUNNER – Training . L’approccio globale all’allenamento –
ed. Cooperativa Dante Novara 1992
- D.SCHIMDTBLEICHER – Adattamenti neuronali e metodi di allenamento della
forza – ed. SDS Rivista di cultura sportiva Roma 1983
- F.SAIBENE,B.ROSSI,G.CORTILI – Fisiologia e psicologia degli sport – ed.
Mondadori Milano 1986
- J.V.VERCHOSANSKIJ – Lo sviluppo della forza specifica nello sport – ed. Atletica
Leggera Vigevano 1984
- E.R. KENDEL,J.H.SHWARTZ – Principi di neuroscienze – ed. Ambrosiana Milano
1988
- G.MORUZZI – Fisiologia della vita di relazione – ed. UTET Torino 1981
- P.E.DI PRAMPERO – La locomozione umana su terra , in acqua, in aria – ed. Ermes
Milano 1985