



CHAPTER 1

THE SCOPE OF THE RESEARCH

1.1 INTRODUCTION AND BACKGROUND

During October 2007 a landmark event occurred with the first ever international conference held at the Harvard Medical School in Boston, USA, dedicated to fascia research. The First International Fascia Research Congress was used as a catalyst for all scientific researchers and practicing healthcare professionals to learn from each other and to gain new insights into the human body's soft tissue web. As demonstrated by this research study, the exploration of this new frontier in medicine is bound to lead to the solution of many sport related injuries that to date have been considered as unsolvable. The integration of this new knowledge with regard to the continuous myofascial web together with the existing knowledge base is bound to fill many gaps that exist in current theoretical perspectives.

In a recent article by Harden (2007), he concludes, based on an extensive MEDLINE literature review, that “no successful, comprehensive, consensus- or empirical based effort to determine clinically valid diagnostic criteria for myofascial pain syndrome” has been done since the groundbreaking work of Travell & Simons (1999). Of the 135 references in his article, only five have been published during the last five years (Desmeules *et al.*, 2003; Harden *et al.*, 2003; Staud, 2003; Gerwin *et al.*, 2004 and Shah *et al.*, 2005). Of these five references, one (Gerwin *et al.*, 2004) deals with an extension of the research by Travel & Simons (1999) while the other four address fibromyalgia pain syndrome. Limited publications are encountered in the alternative medicine publications, such as the work by Gemmell *et al.* (2005) which deals with a single case study on myofascial distortion treatment of a tennis player.

The contribution of this research study is groundbreaking in the sense that it provides empirically based evidence of the fundamental role that the continuity of the myofascial web plays in fascia related injuries such as Chronic Posterior Compartment Syndrome (CPCS). The success of the research could be largely



contributed to the qualitative approach that had been followed coupled with the exploration of the characteristics and role that fascia plays in CPCS.

In addition to groundbreaking theoretical concepts developed by the research study, a qualitative research methodology has been followed which is a unique approach to a field normally dominated by quantitative methodologies. This approach enabled the progressive development of the theory basis for the causal relationships which leads to the development of CPCS. The initial apprehension of the researcher about the use of a *qualitative* paradigm was progressively eliminated. The approach proved to be as powerful as the identification of the theoretical gaps which existed in the current theory about the pathogenesis of CPCS. The deductive logic and systematic elimination of rival theories generated profound results that would not have been possible with a research approach based on the inference from observation and statistics.

The objective of the first chapter is to provide the reader with a high-level overview of the thesis. It provides the contextual background to the reasons and motivation for the research project. It deals chronologically with a high-level overview of the research problem; the research question; the associated investigative questions; key research objectives; significance of the research; the research process that was followed; research design and methodology; research assumptions; research constraints; and the contextual boundaries to the research.

The chapter concludes with an overview of the thesis structure as well as a section on chapter and content analysis. Although the first chapter provides a picture of the progressive development of the research study, the structure of the thesis does not reflect this chronology. The section on chapter and content analysis thus provides a framework for the interpretation of the functional structure of the thesis.

1.2 THE RESEARCH PROBLEM

Since the mid-1980's, a much greater awareness existed in terms of the benefits of regular exercise (Lee *et al.*, 2000; Oguma *et al.*, 2002; Taunton *et al.*, 2002;



Cornelissen & Fagard, 2005; Williams, 2007). This awareness has led to an exercise boom, and for many, running have become the exercise of choice as result of its convenience, health benefits and economical considerations. Running as the most popular leisure sports activity is widely recognised (Taunton *et al.*, 2002; Van Sluijs *et al.*, 2004).

It is however also important to realise the negative side of running (van Mechelen, 1992; Plastaras *et al.*, 2005; van Gent *et al.*, 2007). The annual sport injury rate amongst runners according to van Gent *et al.* (2007) for lower extremity running injuries in long distance runners ranges from 19.4% to 79.3%. These findings support the work of Taunton *et al.* (2002) who analysed 2002 running injuries. In accordance with their findings the highest incidence of injuries was associated with the lower leg. With recreational runners, the highest incidence rate was that of knee injuries, whereas lower leg and foot injuries were more prevalent in the elite middle distance runners. Taunton *et al.* (2002) classified patients as having a running injury if:

- “they had pain or symptoms during or immediately after a run;
- they had pain or symptoms within the approximate time span of beginning a running programme;
- the injury was felt to be related to running; and
- the injury was significant enough to force them to stop running or significantly reduce their running mileage and seek medical assistance.

Not all of these injuries respond well to conservative treatment (Swain & Ross, 1999; Fraipont & Adams, 2003). Some of these injuries only respond to surgical therapy (Martens *et al.*, 1984; Gerow *et al.*, 1993). The effect of surgical intervention on the longer term is however not always successful (Verleisdonk *et al.*, 2004), and also not very attractive for the elite athletes. As a result many promising athletes are forced to take-up a less demanding sport. One of these injuries that do not respond to conservative treatment is *chronic posterior compartment syndrome*. Martens *et al.* (1984) is even of the opinion that no place exists for the conservative treatment in the management of this pathology.



The research problem

No known successful conservative treatment exists for the symptoms of chronic posterior compartmental syndrome (CPCS) in runners.

1.3 THE RESEARCH QUESTION

Compartment syndrome is a pathological condition of skeletal muscle characterized by increased interstitial pressure within an anatomically confined muscle compartment that interferes with the circulation and function of the muscle and neurovascular components of the compartment (Nicholas & Herschman, 1995a). The initial complaint of the patient is usually one of pain or a deep ache over the involved compartment. If this condition occurs in the posterior compartment of the lower leg, it is referred to as “*posterior compartment syndrome (PCS)*”. The condition is considered to be chronic when the symptoms persist for longer than three months (Klenerman *et al.*, 1995; Von Korff & Saunders, 1996; Grabois, 2005).

In addition to the lack of response to conservative treatment, it is also not easy to diagnose “*chronic posterior compartment syndrome*”. A thorough history, a careful physical examination as well as the testing of intra-compartmental pressures are considered by some as essential to establish the diagnosis (Fraipont & Adamson, 2003). The healthcare practitioner thus often has to deal with a situation where the symptoms are clearly manifested, but the diagnosis of the underlying cause not that obvious. The objective of the research is to develop soft tissue mobilization techniques that will provide a relief of the symptoms of posterior compartment syndrome, irrespective of whether the underlying cause is CPCS or for example “*medial stress syndrome*” which is often confused with the former. Both of these conditions present with the same symptoms do not respond to conservative treatment and both do respond favourably to surgical treatment. This difficulty of a proper diagnosis has a direct bearing on the title of this research study. The title is “*The effect of soft tissue mobilization techniques on the symptoms of chronic posterior compartment syndrome in runners*”. The objective is thus to find a conservative treatment approach for practitioner who do not normally have access to the facilities for a differential diagnosis of the underlying cause of these symptoms.



The current physiotherapy treatment that is prescribed for PCS consists mainly of the treatment of the involved calf muscles. Treatment techniques include cross frictions, massage, ultrasound- and interferential treatment, calf muscle stretches and eccentric strengthening exercises of the calf muscles (Davey *et al.*, 1984; Martens *et al.*, 1984; Detmer *et al.*, 1985; Melberg & Styf, 1989; Biedert & Marti, 1997; Blackman *et al.*, 1998; Schepsis & Lynch, 1998; Micheli *et al.*, 1999; Garcia-Mata *et al.*, 2001). None of these interventions provided any significant lasting effects on the symptoms of CPCS (Davey *et al.*, 1984; Biedert & Marti, 1997; Fraipont & Adamson, 2003). Elite runners are often sceptical of the surgical option. The first consideration is the effect of the treatment option on their ability to train, since they are unable to train for a period of time post- operatively. Secondly, there is also a great deal of uncertainty with regard to the success rates of the surgical option. Another alternative available to the runner is a decrease in his training programmes to the extent that he no longer experience symptoms (Ross, 1996). None of these options are acceptable to dedicated long distance runners, and this has resulted in many promising athletes changing from running to a physically less demanding sport.

The research question

Can a successful conservative treatment regime/approach be developed for runners with symptoms of CPCS?

1.4 INVESTIGATIVE QUESTIONS

It is the intent to answer the following investigative questions in this thesis:

- *Why are the current known conservative approaches to the treatment of CPCS unsuccessful?*
- *Are there any theoretical gaps in the treatment of CPCS?*
- *Can an improved theoretical framework for the pathogenesis of CPCS be developed?*
- *Can such a model be used to develop a successful conservative treatment regime for the condition?*



- *Would the application of such a conservative treatment approach in a multiple case study experiment provide sufficient replication of results to validate such a model?*
- *Do other biomechanical deviations/abnormalities play a role in the perpetuation of the condition?*
- *Would the successful treatment of the conditions resolve such abnormalities?*
- *Would the envisaged theoretical framework for CPCS be able to explain and clarify the underlying cause-effect relationships involved?*

1.5 KEY RESEARCH OBJECTIVES

The key research objectives are:

- *To develop an enhanced theoretical framework as basis for the treatment of CPCS in runners.*
- *To develop a successful conservative methodology for the treatment of CPCS in runners.*
- *That theoretical contributions formulated within the ambit of this thesis in addition to academic contributions also provide for practical application in solving the frustrating effects of CPCS in both runners and the therapists involved with the treatment of the condition.*
- *To make a significant contribution to the existing body of knowledge with specific reference to a more holistic approach towards the clinical treatment of myofascial system related dysfunctions in the field of physiotherapy.*
- *That such a holistic approach to the treatment of soft tissue dysfunctions would lead to paradigm shift in the treatment of sport injuries in general.*

1.6 SIGNIFICANCE OF THE RESEARCH

A successful conservative treatment for the symptoms of CPCS would be a major breakthrough. The current physiotherapy approaches, reported on in the literature,



provide no lasting success, whilst the documented surgical option also has a limited success rate, especially with regard to the posterior compartment. A successful conservative approach, alleviating the symptoms of CPCS, could form the basis for the successful treatment of other chronic fascia-related injuries such as iliotibial band syndrome, plantar fasciitis and chronic compartment syndromes (CCS) of the other compartments of the lower leg.

Such an approach for the treatment of the symptoms of CPCS could have positive economic and psychological implications. The consequence of a successful treatment through manual, conservative means, would be that costs will be saved on surgery, hospitalization, post-operative rehabilitation and many promising athletes would be able to continue their sport careers.

1.7 THE RESEARCH PROCESS

The research process consisted of two major phases. Phase 1 consisted in essence of exploratory research, aimed at the development of a methodological framework for CPCS. In phase 2, the focus was on the verification and validation of both the theoretical model and treatment methodology developed for the symptoms of CPCS.

1.7.1 Phase 1 – Exploratory research

This phase consisted of an initial literature research aimed at CPCS, as well as at research methodologies. The following sections provide a brief overview of this phase which is also reflected in Figure 1.1.

○ Literature research

The literature study was aimed at two aspects. The first dealt with research methodology aimed at the development of a sound framework for the execution of the research. The second dealt with the current theoretical status of CPCS in order to establish a framework as basis for the development of a treatment regime as well as the basis for predicting the effect of such treatments.

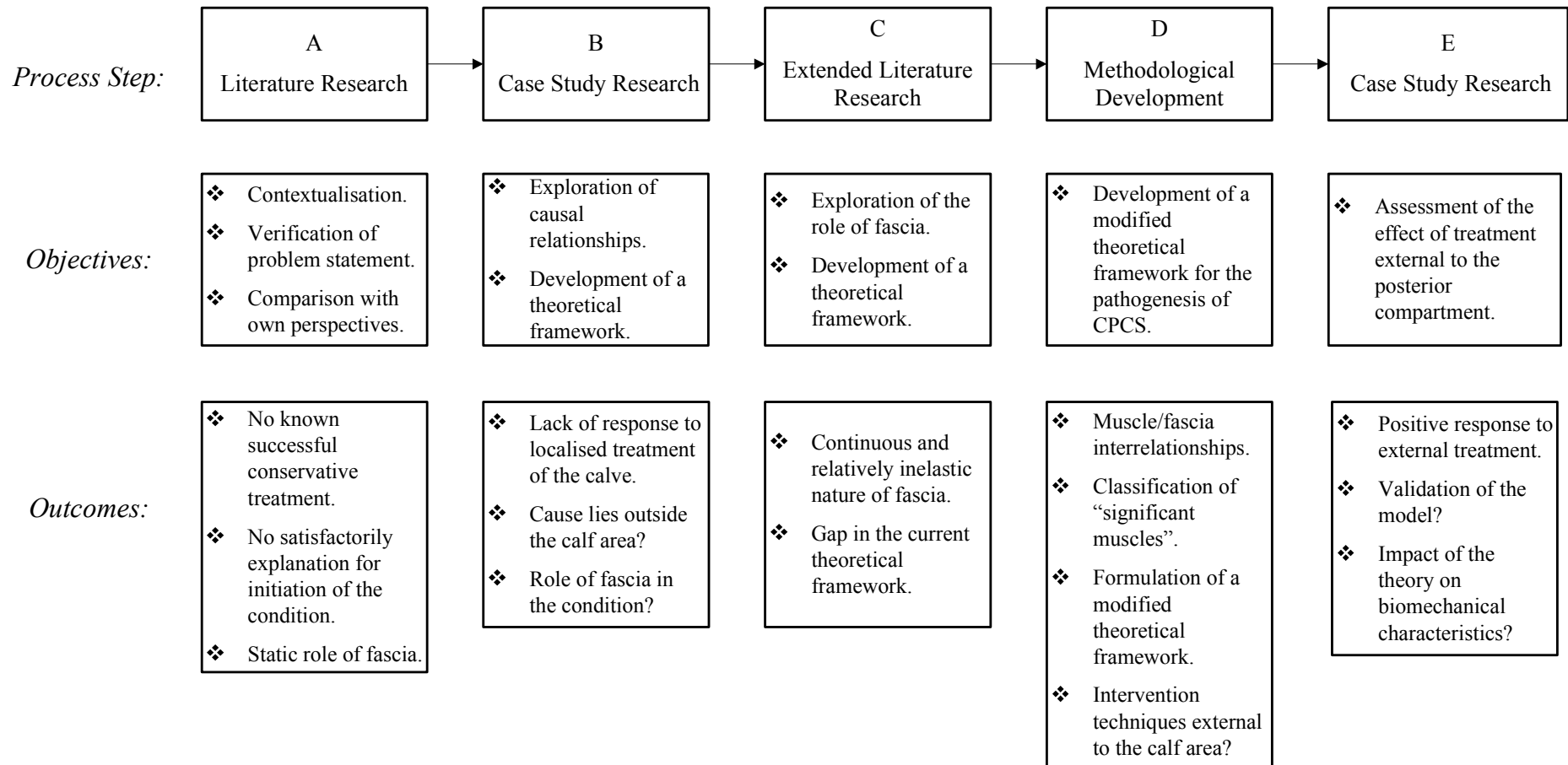


Figure 1.1: The explanatory research process – Phase 1



- **Exploratory research**

Initial exploratory work aimed at the validation of the existing theoretical framework for the pathogenesis of CPCS followed. This phase identified the shortcomings in the current theoretical model. Progressive exploratory work indicated that the cause of the symptoms lies outside the calf muscles. These findings coupled with the continuous nature of the myofascial web led to the development of a revised or modified model for the pathogenesis of CPCS. This revised model formed the theoretical base for the development of the treatment interventions.

- **The identification of the clinically significant muscles and myofascial links**

In this phase the focus was on the identification of muscles that are linked via the myofascial web to the muscles of the posterior compartment. This research also led to the realisation that the continuous nature and relatively non-elasticity of fascia have been ignored in the theoretical treatment of the condition. This theoretical gap strongly supported the deductions made from the exploratory research in terms of the pathogenesis of CPCS. The newly modified theoretical model postulates that the cause of the symptoms lies outside the calf area. This led to the development of the concept of *clinically significant muscles*. These muscles were identified based on literature and validated during clinical trials.

1.7.2 Phase 2 – Explanatory research

- **Case study research**

During the explanatory research phase the validity of the newly developed theoretical framework as well as the treatment methodology were assessed. Phase 2 consisted of both case study research as well as experimental research. Phase 2 is also reflected in Figure 1.2.

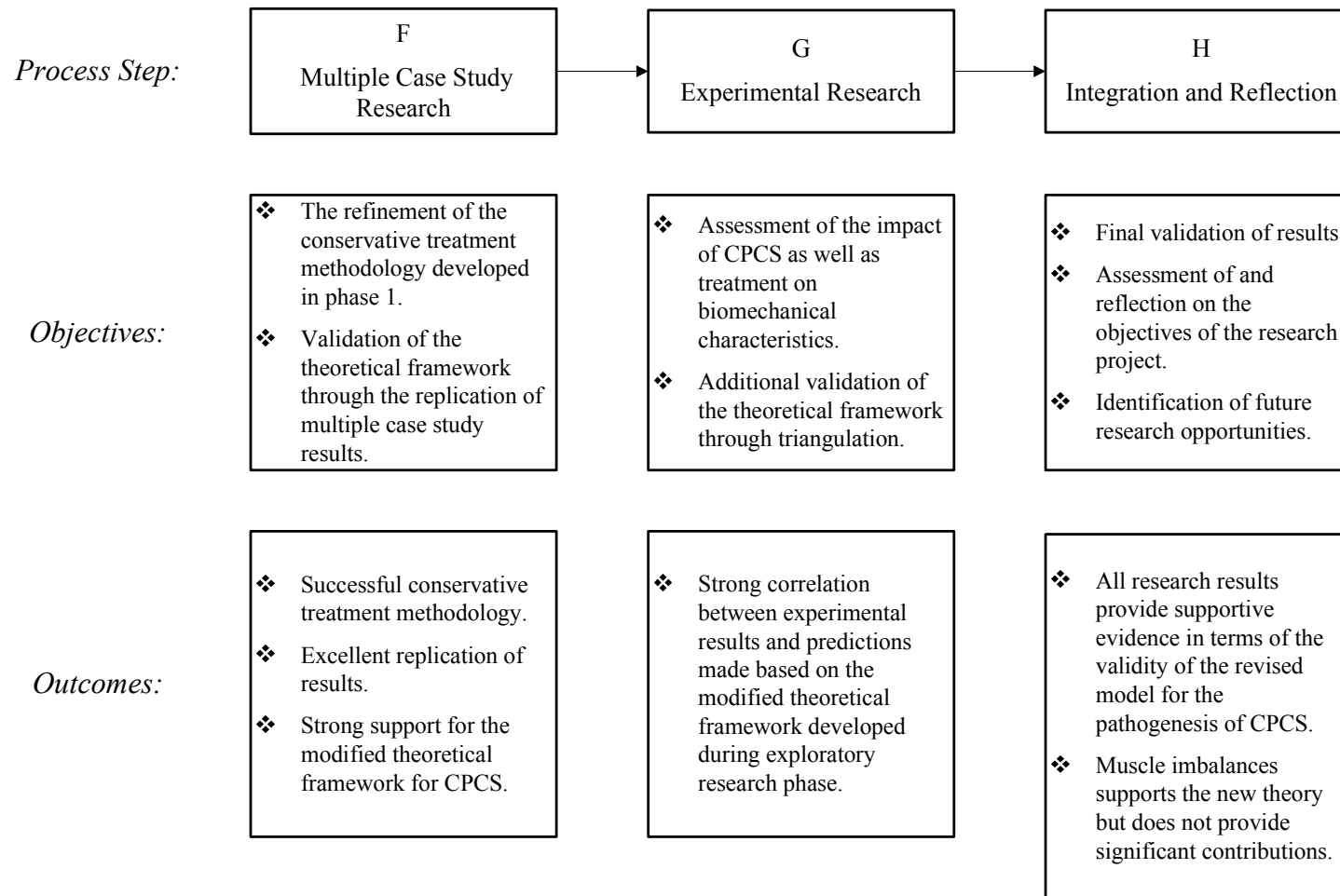


Figure 1.2: The explanatory research process – Phase 2



- **Multiple case study research**

The focus of the case study research was on the validation of both the theory and techniques through *replication logic*.

- **Experimental research**

The aim of the experimental research was to investigate the effect of CPCS on selected biomechanical properties. It also provided an opportunity for experiment aimed at eliminating the influence of the researcher. This was achieved by means of a team of under-graduate students which performed the experiment. The results of the experiment also provided statistically significant results in spite of the relatively small sample size involved.

- **Integration and reflection**

The last element in phase 2 consisted of the final integration of results. The question was whether sufficient evidence could be provided through the triangulation of results for generalisation.

1.8 THE RESEARCH DESIGN AND METHODOLOGY

By the very nature of the research question, the research is imbedded in the physical and natural world. Although research in this domain is normally based on the classical scientific method with well-established experimental approaches (Remenyi *et al.*, 2002), this research approach deviated from the norm in the sense that it involved both a qualitative, theory-building component as well as a quantitative component.

The focus of the first part of the research is on exploratory research with the key objective of developing an enhanced understanding of the condition of CPCS. The focus is thus on creating understanding of causal relationships that exist with the condition.



In the second part of the research, the focus is on the application of the theory-building component. The objective with the second part is to develop and validate a treatment intervention based on the theoretical base that was developed. This phase thus deals primarily with deductive reasoning while the first primarily relies on inductive reasoning.

The research thus entails an overlap between qualitative and quantitative methodologies. Although one can make a clear distinction between qualitative and quantitative research, it does not imply identification with either at the exclusion of the other (Babbie, 2005). The use of both often forms the basis of a complete understanding of the subject at hand.

1.9 RESEARCH ASSUMPTIONS

Watkins (2006: 53) provides the following quotation from Leedy & Ormrod (2001: 62-63) which eloquently describes the importance of assumptions in research.

“Assumptions are what the reader takes for granted. But taking things for granted may cause misunderstanding. What we may tacitly assume, others may never have considered. If we act on our assumptions, and if in the final result, such actions make big differences in the outcome, we may face a situation we are totally unprepared to accept. In research we try to leave nothing to chance in the hope of preventing any misunderstanding. All assumptions that have material bearing on the problem should be openly and unreservedly set forth. If others know the assumptions a researcher makes, they are better prepared to evaluate the conclusions that result from such assumptions. To discover your own assumptions, ask yourself, what am I taking for granted with respect to the problem? The answer will bring your assumptions into clear view”.

At the outset of the research project a number of assumptions were made. These included the following:

- The condition of CPCS was not caused solely due to muscle exertion.



- The condition has to be triggered by some variable or variables that were not considered in the current theoretical treatment of the condition.
- The lack of success with conservative treatment interventions was due to the fact that the current theoretical framework employed as basis for such interventions was incomplete.
- It is possible to develop a successful conservative treatment for the condition.
- It will in all probability be possible to validate the envisaged theoretical base as well as the treatment approach by means of replication in a multiple case study design due to the nature of the biomechanical characteristics associated with the condition.

1.10 RESEARCH CONSTRAINTS

A number of constraints existed that influenced the execution of the research. These constraints are briefly reflected on in the following section.

- The theoretical framework that existed for CPCS had obvious deficiencies that prohibited the use thereof as a basis for the prediction of replication in a multi case study approach.
- The lack of an adequate theoretical framework prohibited the use of classical laboratory experimentation.
- This lack of an adequate theoretical framework also called for a less structured approach with regard to research methodology due to the progressive nature of the research (Olivier, 2004).

1.11 CONTEXTUAL BOUNDARIES

1.11.1 Limitations

- The verification of the success of the treatment interventions is limited to the subjective assessments of the subjects. It excludes sophisticated diagnostics such as the measurement of pressures within the involved posterior compartment.



- The small sample sizes of subjects added a limitation to the use of statistical analysis as a basis for the verification of results.
- From an ethical perspective it was imperative that the research was continuously focussed on the improvement of the subject's performance. This excluded intermittent strategies such as controlled periods of no intervention.
- Intervention techniques will be limited to acknowledged "best practices" as applied by the practising sport physiotherapy community in order to enhance the general applicability of treatment interventions resulting from the research.

1.11.2 Delimitations

- The research excludes the anatomical analysis of the myofascial structures and is limited to published research results as contained in the literature.
- The research excludes the measurements of the actual pressures within the posterior compartment.
- The measurements of biomechanical effects are limited to aspects that are affected by the condition and which are measurable.

1.12 CONCLUSION

The salient features of this chapter are that it provides an overview of the research problem, the research question as well as investigative questions, constraints, limitations and delimitations of the research. It provided a contextual background to the research, as well as a perspective on the contributions made by the research study. It provides the reader with an insight into the structure and the methodological approach followed with the research project. In the next chapter the literature review will be covered. The review consists of four major sections, namely a review of the research methodology; CPCS; fascia (collagen tissue) and myofascial links; as well as a review of biomechanical factors linked to CPCS by this research.

It provides a systematic, critical and integrated discussion of the literature research findings and also provides a clear and explicit description of the key concepts as covered in this thesis.



In reviewing the research methodology special attention will be given to the use of multiple case study research in exploratory research; the importance of a sound theoretical framework for explanatory research; as well as the concept of “replication logic”.

The research makes use of the triangulation of results as encountered in mixed methodological paradigms and these concepts are thus also explored. In this regard some of the biomechanical aspects are investigated by means of classical experimentation and some of these requirements are reflected on in the concluding part of Chapter 2 dealing with research methodology.