

Islamic University – Gaza

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Master Degree of Community Mental Health (Rehabilitation Sciences)



**Shoulder Pain among Rehabilitated Spinal Cord-Injured
Persons who are Using Manual Propelled Wheelchairs in
Gaza Strip: A Survey Study**

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Abstract

Background: Shoulder pain among paraplegic persons has negative effects on their lives. The prevalence of shoulder pain among SCI person varies in different studies between 30% to 70%, and it may be related to repetitive use of shoulder during self care and wheelchair-related activities.

Objectives: The overall objective of this study was to describe the prevalence of shoulder pain and its effects on ADL's and social participation among spinal cord-injured paraplegic wheelchair users in Gaza strip. Specific objectives were to investigate the severity of shoulder pain following discharge from rehabilitation, to explore possible risk factors behind shoulder pain, to describe the effect of pain on functional, work and daily living activities, to define the effect of pain on recreational or athletic activities, and to detect the degree of satisfaction about the overall functioning of the shoulder.

Study Design: Cross sectional survey design was used.

Methods: Eighty rehabilitated paraplegic adult persons with traumatic or nontraumatic spinal cord injury(SCI), who are using manual wheelchairs, and living in Gaza strip have participated in this study. After giving informed consent, the subjects were interviewed directly to fill questionnaires including the demographic data ,Wheelchair User's Shoulder Pain Index (WUSPI) and Shoulder Rating Questionnaire(SRQ) .

Collected data was entered and analyzed using Statistical Package for the Social Sciences (SPSS).

Results: Prevalence rate of shoulder pain among paraplegics who are using manual wheelchair was 62% of subjects. Pushing a wheelchair for 10 min or more , and pushing up ramps or inclines outdoors were the most common activities that cause and exacerbate shoulder pain. Putting on a T-shirt or pullover, putting on a button-down shirt, and loading the wheelchair into a car were the least activities that cause shoulder pain.

Sixty four percent from the sample describe their ability to use their shoulder as having no limitation during daily personal and household activities and the remaining faced different degree of limitation, and 74% from the sample reported no limitation during recreational or athletic activities, the rest (26%) agreed that pain has variably limited their participation in these activities.

Fourteen percent from the sample showed that the overall degree of satisfaction with their shoulder functioning were fair, and the others rated their satisfaction from good to excellent satisfaction.

Conclusion Shoulder pain is common, and a high prevalence rate was observed after traumatic and nontraumatic spinal cord injury. Shoulder pain has a negative effect on activities of daily living especially while pushing wheelchair for 10 min or more, and during pushing the wheelchair up ramps or inclines outdoors.

Key Words: Shoulder Pain, Spinal Cord Injury, Paraplegia, Manual Wheelchair.

ملخص الدراسة

خلفية الدراسة: الأم الكتف لها آثار سلبية على حياة مرضى الشلل النصفي. شيوع الأم الكتف بين مرضى إصابات النخاع الشوكي تتنوع في مختلف الدراسات ما بين 30% إلى 70% ، والأم الكتف قد يكون سببها الاستخدام المتكرر للكتف من خلال العناية الذاتية والأنشطة ذات الصلة بالكراسي المتحركة.

أهداف الدراسة : الهدف العام لهذه الأطروحة هو وصف معدلات شيوع الأم الكتف وآثاره على الأنشطة الحياتية اليومية والمشاركة الاجتماعية بين مصابي النخاع الشوكي- (الشلل النصفي)- الذين يستخدمون الكراسي المتحركة في قطاع غزة.

أما الأهداف الخاصة يهدف إلى البحث عن شدة الأم الكتف بعد الخروج من مركز التأهيل لمصابي الشلل النصفي ، و إلى استكشاف العوامل الكامنة وراء المخاطر المحتملة للأم الكتف ، و لوصف تأثير الألم على الأنشطة الوظيفية ، وعمل الأنشطة اليومية المعيشية ، و لتحديد أثر الأم الكتف على الأنشطة الترفيهية أو الرياضية ، وأخيرا تهدف هذه الدراسة إلى الكشف عن درجة الرضا عن وظيفة الكتف.

تصميم الدراسة وأسلوبها : أجريت هذه الدراسة المسحية التحليلية التقاطعية على عينة مكونة من ثمانين شخص بالغ مصاب بالشلل النصفي (paraplegics) نتيجة الإصابة في النخاع الشوكي

وتم تأهيلهم في مستشفى للتأهيل في قطاع غزة ويستخدموا الكراسي المتحركة

بعد إعطاء الموافقة على المشاركة في الدراسة ، تم تعبئة الاستبيانات عن طريق إجراء مقابلات وجها لوجه متضمنة البيانات الشخصية واستبيان مؤشر الأم الكتف لمستخدمي الكرسي المتحرك (WUSPI) واستبيان تقدير أم الكتف (SRQ) كمقياسين لقياس أم الكتف .

تم إدخال و تحليل البيانات المجمع باستخدام الحزمة الإحصائية للعلوم الاجتماعية (SPSS).

النتائج : معدل انتشار أم الكتف بين مصابي الشلل النصفي الذين يستخدمون الكرسي المتحرك كان 62 ٪ من المشتركين في الدراسة. دفع الكرسي المتحرك لمدة 10 دقيقة أو أكثر ، ودفعه في الرصيف المخصص للمعاقين أو الطرق المنحدرة كان أكثر الأنشطة التي تسبب وتفاقم أم الكتف. في حين أن ارتداء القميص أو البلوزة ووضع أزرار القميص و تحميل الكرسي المتحرك داخل السيارة كانت أقل الأنشطة التي تسبب أم الكتف في الكتف.

حوالي 64 ٪ من العينة وصفوا قدرتهم على استخدام الكتف بعدم وجود تقييد أثناء تأدية الأنشطة اليومية الشخصية والمنزلية وحوالي 74 ٪ من العينة أكدوا قدرتهم على استخدام الكتف بدون وجود تقييد أثناء تأدية الأنشطة الرياضية و الترفيهية وأما الباقون (26%) فلقد أثر بهم الألم بدرجات متنوعة من التقييد.

67.5 ٪ من العينة كانوا عاطلين عن العمل ، حوالي 14 ٪ من العينة الكلية درجة الرضا عن وظيفة الكتف لديهم كانت ضعيفة ، والباقون تراوحت درجة رضاهم من جيدة إلى ممتازة.

وختاما : آلام الكتف شائعة،وقد لوحظ معدل انتشار عالي بين مصابي النخاع الشوكي. آلام الكتف لها تأثير سلبي على أنشطة الحياة اليومية وخاصة دفع الكرسي المتحرك لمدة 10 دقيقة أو أكثر ، ودفعه في الرصيف المخصص للمعاقين أو الطرق المنحدرة .

الكلمات الدالة : آلام الكتف ، إصابة الحبل الشوكي ، الشلل النصفي ، كرسي متحرك.

Dedication

I dedicated this work to

my parents,

my wife ,

and my brothers

who has shown unconditional love and support from beginning to end.

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Table of Contents

Abstract in English.....	i
Abstract in Arabic.....	ii
Dedication	iv
Acknowledgements.....	v
List of Content	vi
List of Tables	x
List of Figures	xiii
List of Abbreviations	xiv
Table of Annexes	xv

Chapter one: Introduction

1.1 Overview	2
1.2 Geography and Demography of Palestine.....	4
1.3 Al Aqsa Intifada	6
1.4 Objectives of the study.....	7
1.4.1 General objectives.....	7
1.4.2 Specific Objectives	7
1.5 Significance of the study.....	7
1.6 Operational Definitions of Study Terms	8
1.5.1 Spinal Cord Injury.....	8
1.5.2 paraplegia	8
1.5.3 Shoulder Pain	8
1.5.4 Manual Wheelchair	8

Chapter two: Conceptual framework

2.1 Overview of Spinal Cord Injury.....	11
2.1.1 Incidence and Prevalence of Spinal Cord Injury	13
2.1.2 Causes of Spinal Cord Injury	14

2.1.3	Demographics Data	15
2.1.3.1	Gender	15
2.1.3.2	Educational level	15
2.1.3.3	Age at Injury	16
2.1.3.4	Occupational Status	16
2.1.3.5	Life Expectancy	16
2.1.3.6	Mortality Rates and Cause of Death	17
2.2	Overview of Shoulder	18
2.2.1	Anatomy of Shoulder	18
2.2.2	Shoulder Pain Caused by Wheelchair Propulsion	20
2.3	Wheelchairs for SCI patients	23
2.3.1	Manual Wheelchairs	23
2.3.1.1	Standard Wheelchair	23
2.3.1.2	Light Weight Folding Wheelchair	24
2.3.1.3	Rigid Manual Wheelchair	24
2.3.1.4	Special Positioning Wheelchair	25
2.3.1.5	Special Terrain Wheelchair	25
2.3.1.6	Sport Chairs and Cycles	26
2.3.2	Power wheelchairs	26
 Chapter 3: Literature Review		
3.1	Prevalence of Shoulder Pain among SCI Patients	29
3.2	Level of Manual Wheelchair Skill Performance and Participation	32
3.3	Risk Factors Cause and Aggravate Shoulder Pain	35
3.4	Effects of Interventions to decrease Shoulder Pain	39
3.5	Studies Conducted Concerning Wheelchairs	42
3.6	Summary of Literature	45

Chapter four: Methods and Materials

4.1	Research Design and Plan	47
4.2	Research Population	49
4.3	The Inclusion Criteria	49
4.4	The Exclusion Criteria	49
4.5	Questionnaire Design and Content	50
4.6	Study Setting and Period of Study	51
4.7	Ethical consideration and Procedure	51
4.8	Piloting the Instrument	51
4.9	Validity of the Research	52
4.9.1	Content Validity of the Questionnaire	52
4.9.2	Statistical Validity of the Questionnaire	53
4.9.3	Criterion Related Validity	53
4.10	Reliability of the Research	56
4.10.1	Split Half Technique	56
4.10.2	Cronbach's Alpha	57
4.11	Data entry and Analysis	57
4.12	Limitations of the Study	58

Chapter Five : Study Result

5.1	Population Characteristics	60
5.2	Wheelchair User's Shoulder Pain Index	62
5.3	Shoulder Rating Questionnaire	63
5.3.1	Questions Referring to Pain.....	64
5.3.2	Questions Referring to Daily Activities	66
5.3.3	Questions Referring to Recreational or Athletic Activities	69
5.3.4	Questions Referring to Work	71
5.3.5	Questions Referring to Satisfaction and Areas for Improvement	74

5.4 Population Characteristics and Shoulder Pain	75
5.4.1 Population Characteristic and Shoulder Pain	
at Rest and During Activities	75
5.4.2 Population Characteristic and Pain which Make	
Sleep Difficulty at Night	76
5.4.3 Population Characteristic and Severity of Shoulder Pain	76
5.4.4 Population Characteristic and the Ability of shoulder Using	77
5.4.5 Population Characteristic and Recreational and Athletic Activities	78
5.4.6 Population Characteristics and Work	79
5.4.7 Population Characteristics and Satisfaction	82
Chapter six: Discussion , Conclusion, and Recommendations	
6.1 Overview	85
6.2 Population characteristics	86
6.3 Causes of Injury	87
6.4 Shoulder Pain Related to Activities of Daily Living	87
6.5 Prevalence of Shoulder Pain	88
6.6 Recreational and athletic activities	90
6.7 Work and Employment	91
6.8 Degree of satisfaction about shoulder pain	93
7.1 Conclusion	94
7.2 Recommendations of the Study	96
References	97

Table of Tables

Table (1) Spearman coefficient correlations (Wheelchair User’s Shoulder Pain Index).....	54
Table (2)Spearman coefficient correlations(Shoulder Rating Questionnaire).....	54
Table (3) Split Half Technique	57
Table (4) Cronbach’s Alpha.....	57
Table(5) Population Characteristics	61
Table (6) Weight mean of the shoulder pain for members of sample study	62
Table (7) Degrees of shoulder affects	64
Table (8) The usual pain in shoulder at rest	64
Table (9)The usual pain in shoulder during activities	65
Table (10)How often did the pain in your shoulder make it difficult for you to sleep at night.....	65
Table (11) How often have you had severe pain in your shoulder?.....	66
Table (12) How would you describe your ability to use your shoulder?	66
Table (13) Putting on or removing a pullover sweater or shirt	67
Table (14) Combing or brushing your hair	67
Table (15) Reaching shelves that are above your head	68
Table (16) Scratching or washing your lower back with your hand	68
Table (17) Lifting or carrying a full bag of groceries (8–10 kg)	69
Table (18) How would you describe the function of your shoulder?	69
Table (19) How much difficulty have you had throwing a ball overhand or serving in tennis due to your shoulder?	70
Table (20) The degree of limitation at shoulder due to activities	70
Table (21) During the past month, what has been your main form of work?	71
Table (22) How often were you unable to do any of your usual work because of your shoulder	72

Table (23) How often were you unable to do your work as carefully or as efficiently as you would like because of your shoulder?.....	72
Table (24) How often did you have to work a shorter day because of your shoulder	73
Table (25) How often did you have to change the way that your usual work is done because of your shoulder.....	73
Table (26) How would you rate your overall degree of satisfaction with your shoulder?.....	74
Table (27) Areas to be improved	74
Table (28) Cross Tabulation between socio-demographic characteristic and shoulder pain at rest and activities	75
Table (29) The relationship between the shoulder pain which make sleep difficulty at night, and population characteristics	76
Table (30) Cross tabulation between population characteristics and severity of shoulder pain	77
Table (31) The relationship between population characteristic and the ability of shoulder using	77
Table (32) The relationship between the function of shoulder during recreational and athletic activities and population characteristics	78
Table (33) The relationship between the difficulty of throwing a ball overhand or serving in tennis due to the shoulder and population characteristics	79
Table (34) The relationship between the main form of work and population characteristics	79
Table (35) The relationship between inability to do usual work because the shoulder population characteristics	80
Table (36) The relationship between inability to do work as carefully or as	

efficiently because the shoulder and shoulder population characteristics	81
Table (37) The relationship between working a shorter day because of the shoulder and population characteristics	81
Table (38)The relationship between changing the way of usual work because the shoulder and population characteristics	82
Table (39) The relationship between overall degree of satisfaction with the shoulder and population characteristics	83

Table of Figures

Figure (1) Conceptual Framework Diagram	10
Figure (2) Anatomy of the Shoulder	18
Figure (3) Standard Wheelchair	24
Figure (4) The Methodology Flow Chart.....	48

List of Abbreviations

- AC : Acromioclavicular
- ADL : Activities of Daily Living
- ASIA : American Spinal Injury Association
- CHART : Craig Handicap Assessment and Reporting Technique
- FIM : Functional Independence Measurement
- DWs : Depot Wheelchair
- GH : Glenohumeral
- LWs : Lightweight Wheelchair
- MOH : Ministry of Health
- MWC : Manual Wheelchairs
- MWCUs : Manual Wheelchair Users
- NSCID : National Spinal Cord Injury Database
- NIS : New Israeli Shekel
- ROM : Range of Motion
- SCI : Spinal Cord Injury
- SPSS : Statistical Package for Social Sciences
- SPADI : Shoulder Pain and Disability Index
- SRQ : Shoulder Rating Questionnaire
- TSCI : Traumatic Spinal Cord Injury
- UL : Upper Limb
- UNRWA : United Nations Relief and Works Agency
- UWs : Ultralight Wheelchair
- WUSPI : Wheelchair User Shoulder Pain Index
- WUFA : Wheelchair Users Functional Assessment

Table of Annexes

Annex (1) Participation Letter in Arabic	107
Annex (2) Questionnaire in Arabic	108
Annex (3) Participation Letter in English	117
Annex (4) Questionnaire in English.....	118

Chapter One

Introduction

Chapter One :Introduction

1.1 Overview

Spinal cord injury (SCI) is an acute and devastating event that results in significant and permanent life changes for the individuals who are injured, as well as their surroundings.

Worldwide, approximately 90 million people currently suffer from SCI and the incidence in developed countries varies from one to five persons per 100,000 (Holtz and Levi, 2006).

The most common cause of injuries are motor vehicle accidents (50%), followed by falls (22%), acts of violence (primarily gun shots wounds) (11%), and recreational sporting activities (8%) (Lin, 2003; Somers, 2001).

SCI results in a complete or partial loss of motor and/or sensory function below the level of injury. It causes extensive functional impairment compelling many persons to wheelchairs usage (Bjerkefors, 2006).

Due to extensive costs of rehabilitation process, non-governmental organizations and various charitably societies came forward to render their free services for physically disabled persons, and the wheelchair is conventionally distributed to persons unable to walk for their independent ambulation and to enhance their social functioning despite impairments .

The wheelchair is still considered as a simple and all purpose ambulatory device and most commonly used due to its excellent maneuverability within a confined space and is an effective propulsion interface which provides the user with maximum feedback and control (Brubaker et al., 1984).

Paraplegic patients have been traditionally rehabilitated to use wheelchairs for functional locomotion and sports practice. Many wheelchairs users experience pain in upper limbs that interfere with essential daily activities, as when propelling the wheelchair itself, driving, dressing, and performing transfer. Some of them stop

propelling their wheelchairs by themselves and invite others to propel them due to pain in their upper extremities especially the shoulder and they become unable to make pressure release.

Based on epidemiological studies, it seems evident that manual wheelchair propulsion and wheelchair-related daily life activities cause a heavy load on the upper extremities, especially for persons with cervical spinal cord injury ,and more than two-third of SCI manual wheelchair users report suffering or having suffered shoulder pain (Curtis et al., 1999b).

Many studies have shown that more than two thirds of individuals with SCI reported suffering or have suffered from shoulder pain since the onset of using manual wheelchairs (MWCs). In addition, upper limb pain as a result of MWCs propulsion may occur as early as five years post SCI. More than 70% of persons with paraplegia of over 20 years experience shoulder pain that may result in a loss of functional independence (Sie et al., 1992).

Other suggested risk factors for the development of shoulder pain are the duration of injury, age (e.g. older people have a higher risk than younger people), higher body mass index (BMI) (Boninger et al., 2001), and wheelchair propulsion style (Boninger et al., 2002).

Surveys involving as many as 450 wheelchair-based individuals find that as many as 73% report some degree of chronic upper-extremity pain, which they attribute primarily to wheelchair propulsion and transfers (Subbarao et al., 1995).

1.2 Geography and Demography of Palestine

Palestine has an important geographic and strategic location, it is situated on the Eastern coast of the Mediterranean sea, in the Middle East.

Gaza Strip is a narrow piece of land lying on the coast of Mediterranean sea. It's position on the crossroads from Africa to Asia made it a target for occupiers and conquerors over the countries. The last of these was Israel who occupied the Gaza Strip from Egyptians in 1967 (MOH,2005).

Gaza strip is very crowded place with an area of 365 sq. Km and constitute 6.1% of total area of Palestinian territory land. In mid year of 2005 the population number was to be 1,389,789 mainly concentrated in cities and small villages , and eight refugees camps that contain two thirds of the population in Gaza strip. In Gaza strip, the population density is 3,808 inhabitants per km² that comprises the following main five governorates: North of Gaza, Gaza City, Mid-Zone, Khan-younis, and Rafa (MOH, 2005).

The Palestinian population living in Palestine territories (Gaza Strip, West Bank and East Jerusalem) was estimated for the year 2004 at 3.6 millions, about 2.3 millions live in West Bank (63.2%), and 1.3 million in Gaza Strip (36.8%) (MOH, 2005).

More than (70%) of the population lives in rural areas (Barghouti, 2001). According to the United Nations Relief and Works Agency (UNRWA) statistics in 2005,(43.8%) of the total number of population in Palestinian territories is refugees (MOH, 2005). Seventy five percent of Gaza Strip population is refugees and 40% of them live in the camps. In Gaza Strip the population density in the refugees' camps is one of the highest in the world (UNRWA, 2006).

Palestinian population is considered to be mostly young .The percentage of population under 15years in Gaza strip is 49.1% and 2.5% above 65years and the median age is 15.4 years (MOH, 2005).

Gaza Strip is considered one of the lowest incomes in the Middle East area. The majority of the income comes from salary of the employees and security persons, while the agriculture products share by reasonable portion in the economy. The economy nowadays mainly depends on international donors that are suspended. International aids were funding some projects and paid the salaries. The economic situation is usually especially after Al-Aqsa Intifada because of frequent closure and restriction of trade. The deteriorating economic situation, limited income and lack of work opportunities lead to low standard of living and inadequate health facilities (MOH, 2004).

Despite poverty the Palestinians are eager to learn, adult literacy ratio among those aged 15 years and more is 91% which is considered among the high percentage literacy rates of Arab countries (MOH, 2004).

1.3 Al Aqsa Intifada

The Israeli authorities continued their policy of invasions of the Palestinian occupied territories using tanks, bulldozers and military warships and fighter planes, helicopters as well the policy of political assassinations. It also continued to pursue its unfair policy and designed explicitly to the bulldozing of agricultural land, uprooting trees and destroying houses and the displacement of families and the confiscation of Palestinian land in order to complete building a wall of apartheid, with total disregard of the international resolutions . These attacks on residential homes, sites, and other civilian property are clear violation of the international human rights standards and the humanity .

The total number of martyrs killed reached 3,844 at the rate of (122 per 100,000 people), of whom 204 were females with a rate of (11 per 100,000 people) and 3,640 males with a rate of (199 per 100,000 people) (MOH, 2005).

The total number of wounded Palestinians reached 54,548 at a rate(12.1 per 1,000 people), of whom 4,369 wounded females at a rate (2.4 per 1,000 people) while the number of male injuries reached 41,179 at a rate of (21.6 per 1,000 people) (MOH, 2005).

As a result of Al Aqsa Intifada most of the injured people became disabled (e.g. spinal cord injury).

The most frequent cause of spinal cord injury found in Gaza city is trauma, accounting for 63.49% of the disabled population. Specifically injuries associated with both Intifadas account for 20.5% and 13.5%. Another 10.3% of cases are attributable to out of home and work accidents respectively. Diseases account for 32.5% of all cases found (MPDL, 2003).

1.4 Objectives of the study

1.4.1 General objective

The aim of this study is to describe the prevalence of shoulder pain and its effects on ADL's and social participation among spinal cord-injured paraplegic wheelchair users in Gaza strip.

1.4.2 Specific Objectives

- (1) Investigation of the severity of shoulder pain following discharge from rehabilitation for paraplegia.
- (2) Identification of possible risk factors behind shoulder pain.
- (3) Description of the effect of pain on functional, work, and daily living activities.
- (4) Identification of the effect of pain on recreational or athletic activities.
- (5) Detection of the degree of satisfaction toward the shoulder functioning.

1.5 Significance of the study

According to the knowledge of the researcher there are no studies have been conducted to determine the extent of shoulder pain and its consequences among paraplegics in Gaza strip, factors which constraint their activities in the community, and affect their quality of life. Also, there are lack of information on this topic in the Arabic region for persons who are using manual wheelchairs .

Moreover, the number of SCI persons is thought in Gaza strip has increased during the Al Aqsa Intifada due to the excessive force, and explosive ammunition used by the Israeli occupation forces against Palestinians civilians. Most of those patients become completely dependent on wheelchairs for mobility and ADL's activities. Unfortunately this large group of disabled are usually overlooked and their pain is not seriously taken.

So this research is needed to provide further information about the prevalence of shoulder pain and its effects in paraplegic persons who are using manually propelled wheelchairs and have good functioning of upper limbs in order to the factors which contribute or exacerbate shoulder pain.

1.6 Operational Definitions of Study Terms

1.6.1 Spinal Cord Injury

Spinal cord injury was defined as any defect in transmission of signals from and to the brain due any disruption of to spinal cord, leading to paralysis below the affected level.

1.6.2 Paraplegia

Paralysis of lower limbs and part or whole of trunk, caused by an interruption to the nerve supply to or from the brain due to injury or any disease in the spinal cord.

1.6.3 Shoulder Pain

Shoulder pain is any pain in or around the shoulder joint.

1.6.4 Manual Propelled Wheelchair

Manual propelled wheelchair is a movable chair mounted on large wheels; constructed for persons who cannot walk, and frequently propelled by themselves.

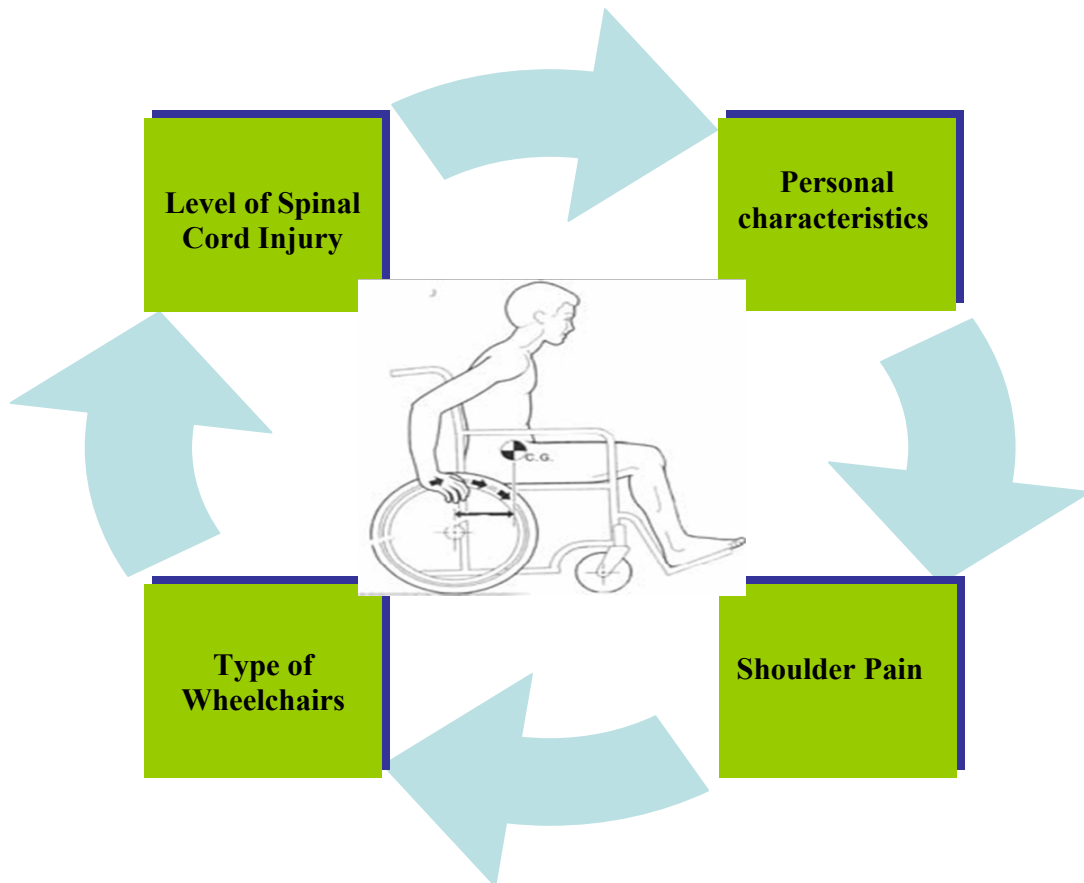
Chapter Two

Conceptual Framework

Chapter Two: Conceptual Framework

This chapter consists of three parts, the first part put the reader on an overview of spinal cord injury, the second part describes the shoulder anatomy and shoulder pain caused by wheelchair propulsion, and the third part discusses the types of wheelchairs especially the manual wheelchairs.

Figure (1) Conceptual Framework Diagram



The above conceptual framework is used to support, guide, and direct the research process to make research findings meaningful and applicable.

2.1 Overview of Spinal Cord Injury

The spine is a series of bones that run from the base of the skull to the pelvis to support the head and body. In a canal that runs the length of the spine is the spinal cord. The bones of the spine usually act as protection for the spinal cord (Dickson & Tonkin, 1987).

The spinal cord consists of nerve fibers that carry messages between the brain and various parts of the body. In many ways the spinal cord is like a telecommunications cable. It connects the main communication centre (the brain) to branch offices (parts of the body) by telephone lines (nerve fibers) (Medical Rehabilitation Research and Training Center in Secondary Complications in Spinal Cord Injury, 1996).

SCI is a traumatic injury, which typically occurs suddenly and without warning. It has an immediate impact on all areas of the individual's physical and psychosocial functioning (Krause & Crewe, 1991).

Spinal cord lesions can be divided into traumatic and non-traumatic, and the proportion of nontraumatic SCI of all SCI lies between 40% and 65% (Catz et al. 2004, Citterio et al. 2004, McKinley et al. 1999).

A SCI occurs when pressure is applied to the spinal cord or the blood supply, which carries oxygen to the spinal cord, is disrupted. Injury to the spinal cord results in paralysis and loss of sensory function below the level of the spinal cord, which is injured (Spinal Injuries Unit Princess Alexandra Hospital, 1992).

The factors determining the extent and severity of the injury/disability are the area of the spinal cord that is damaged (i.e. the level of the lesion) and the amount of damage incurred. The spine is divided into four sections, the cervical (at the top closest to the brain), the thoracic, lumbar, and sacral areas. The closer the damage is to the brain, the higher the level of injury (Medical Rehabilitation Research and Training Center in Secondary Complications in Spinal Cord Injury, 1996).

The two major conditions that result from injury to the spinal cord are paraplegia and quadriplegia. Injuries to the cervical area of the spinal cord generally result in quadriplegia, which is the paralysis of all four limbs, hands and the trunk. Injuries lower in the spine (thoracic, lumbar or sacral areas) result in paraplegia and involve paralysis from the chest or waist downwards. There will be little or no feeling or movement in the lower limbs and the lower part of the trunk (Medical Rehabilitation Research and Training Center in Secondary Complications in Spinal Cord Injury, 1996).

The degree of impairment can vary greatly depending on the type of injury, usually classified as the completeness of the injury. This is the terminology used to describe the severity of the damage to the spinal cord. The terms either “complete injury” or “incomplete injury” are applied. In an incomplete injury some messages are still able to get through between the brain and the rest of the body. There may be some feeling or movement below the level of the injury to the spinal cord. Some people with incomplete injuries have a lot of sensation preserved but little or no movement below the level of their injury. Others have movement but little or no feeling.

The degree of impairment can vary substantially in those who sustain incomplete injuries, for example some people with an incomplete injury may regain the ability to walk (either with or without aids) while others may regain little or no functional movement but may have some preserved sensation in their lower limbs.

Complete injuries are those in which all feeling and function are lost below the level of the injury to the spinal cord. It is as if the communication system between the brain and the other parts of the body is completely cut off. Thus spinal cord injuries can result in complete paraplegia or incomplete paraplegia; and complete quadriplegia or incomplete quadriplegia (Medical Rehabilitation Research and Training Center in Secondary Complications in Spinal Cord Injury, 1996).

American Spinal Injury Association designed the ASIA degree of impairment scale to provide a chart of neurological classification, pinpointing both sensation and the ability to move (ASIA, 2002). This classification system is not only useful in

describing an injury in clear, universal language, but it is also an aid in establishing and tracking progress during acute care and rehabilitation (Senelick & Dougherty, 1998).

The current ASIA degree of impairment scale is classified as follows:

A: Complete Injury. No motor or sensory function is preserved in the sacral segments S4-S5.

B: Incomplete Injury. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5.

C: Incomplete Injury. Motor function is preserved below the neurological level, and more than half of key muscles below the neurological level have a muscle grade less than 3.

D: Incomplete Injury. Motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade of 3 or more.

E: Normal. Motor and sensory functions are normal.

Paralysis results in wheelchair dependence for mobility. Persons with a spinal cord injury may be dependent on others for assistance with many tasks of daily living such as toileting, bathing, dressing, grooming, eating, community access, and recreational activities. (Dorsett, 2001)

2.1.1 Incidence and Prevalence of Spinal Cord Injury

SCI is often an acute and devastating event that results in significant and permanent life changes for the individuals, who are injured, as well as their families and friends.

Worldwide, approximately 90 million people suffer from SCI and the incidence in developed countries varies from one to five persons per 100,000 (Holtz and Levi, 2006).

In the Nordic countries the incidence of traumatic SCI is about 11-16 cases per million inhabitants per year (Biering-Sørensen, 2002), and prevalence rates of 223-755 per million inhabitants have been reported in studies from Australia, Finland, Sweden, and USA (Dahlberg et al., 2005; O'Connor, 2005; Wyndaele and Wyndaele, 2006).

National Spinal Cord Injury Database (NSCID, 2005) has been estimated that 11,000 spinal cord injuries occur each year in the United States and that approximately 222,000 to 288,000 individuals with SCI are currently living in the United States. Between 400-430 people sustain spinal cord injuries in Australia each year (Paraquad NSW, 1997).

The age adjusted incidence rate for SCIs is estimated to be 14.5 per million of population in Australia (O'Connor, 2000). In Sweden, approximately 120 individuals suffer from traumatic spinal cord injury every year, resulting in prevalence of 500 persons (Holtz and Levi, 2006).

2.1.2 Causes of Spinal Cord Injury

In the majority of countries traffic accidents are the most common cause of SCI, accounting for 42-47% of all traumatic SCIs, falls from heights are the next common cause ,and also sports, especially diving in shallow water, and violence are also fairly common causes of SCI (Alaranta et al., 2000; Biering-Sørensen et al., 1990; Jackson et al., 2004).

Also, Lin, (2003) and Somer, (2001) mentioned the same etiologies and reported that, the most common cause of injuries are motor vehicle accidents (50%), followed by falls (22%), acts of violence (primarily gun shots wounds) (11%), and recreational sporting activities (8%). But the NSCID (2005) reported that, since 2000, motor vehicle collisions account for 38.5% to 47.5% of the SCI cases reported and the next largest contributor was falls (22.9%), followed by acts of violence (primarily gunshot wounds) (13.8%) and recreational sporting activities (8.9%).

NSCID (2005) added, the proportion of injuries that are due to sports has decreased over time while the proportion of injuries due to falls has increased. Additionally, the database reported that acts of violence caused 13.3% of SCI prior to 1980, and peaked between 1990 and 1999 at 24.8% before declining to 13.8% since 2000. Since 2000, motor vehicle collisions account for 38.5% to 47.5% of the SCI cases reported.

Cure Paralysis Now (2002) reported resemble results of SCI etiologies and estimated that, the most common cause of SCI is car accidents, which account for about 47% of cases. Falls are responsible for 20% of cases, sports and violence each account for another 14%, and 2% result from other types of accidents. Since 1973, the number of cases from car accidents has been decreasing steadily and the number of cases from falls and violence have been increasing steadily.

The etiology of nontraumatic SCI was spinal stenosis in 24.1%, disc protrusion in 14.6%, multiple sclerosis in 21.8%, tumor (e.g. meningioma, ependymoma, astrocytoma, schwannoma, and hemangioma) in 20.3%, myelitis in 6.5%, other infection in 4.7%, C1-C2 instability (mostly associated with rheumatoid arthritis) in 2.7%, vascular malformation in 2.2%, spinal cord ischemia after non-spinal surgery in 1.6%, and spina bifida in 0.7%. The cervical spinal cord was affected in 32.1% of the cases, thoracic spinal cord in 45.2%, and the lumbar in 22.8%. Less than 3% of the injured had complete lesion. (Medical Rehabilitation Research and Training Center in Secondary Complications in Spinal Cord Injury, 1996).

The researcher noted that, all of epidemiological studies which listed before have been agreed about that: car accidents is the first cause of injury, and falls is the next cause followed by acts of violence and sports activities.

2.1.3 Demographics Data

2.1.3.1 Gender

The majority of the persons with SCI (70-80%) are men, but women have increased their proportion during the last years (Alaranta et al., 2000; Biering-Sørensen et al., 1990; Jackson et al., 2004), and according to the NSCID (2005), since 2000, 79.6 % of the cases are male, with a slight trend toward a decreasing percentage of males, with 81.1% of new injuries among males prior to 1980.

2.1.3.2 Educational level and Marital Status

The educational levels of individuals with SCI tend to be lower than those of the general population, and most people with SCI have never been married at time of injury (51.8%), with the reduced likelihood of getting married after injury (NSCID, 2005).

2.1.3.3 Age at Injury

SCI chiefly affects young people between the ages of 16 and 30. They account for 55% of all SCI, with 80-82% of cases occurring in males (Cure Paralysis Now, 2002).

It was reported that, the mean age at injury has risen during the last years, to be 38-39 years (Alaranta et al., 2000; Jackson et al., 2004). In contrast, Wyndaele and Wyndaele (2006) detected that the mean age at injury is 33 years, and Holtz and Levi (2006) reported, the median age is approximately 30years, and male to female ratio is 4:1.

Catz and his colleagues from Israel mentioned that, the mean age at the injury among persons with non-traumatic SCI was 47.8 years (range 0-82 years), which is clearly higher than that for persons with traumatic SCI, and the male/female ratio was 1.2:1 (Catz et al., 2004).

2.1.3.4 Occupational Status

The NSCID (2005) reported that more than half (64.1%) of individuals admitted to a Model System reported being employed at the time of injury. At 10 years post-injury, individuals with paraplegia are more likely to be employed (32.8%) than those with tetraplegia (24.7%).

2.1.3.5 Life Expectancy

Although life expectancies for individuals with SCI continue to increase, they are still somewhat below life expectancies for those without SCI(NSCID ,2005) .

2.1.3.6 Mortality Rates and Cause of Death

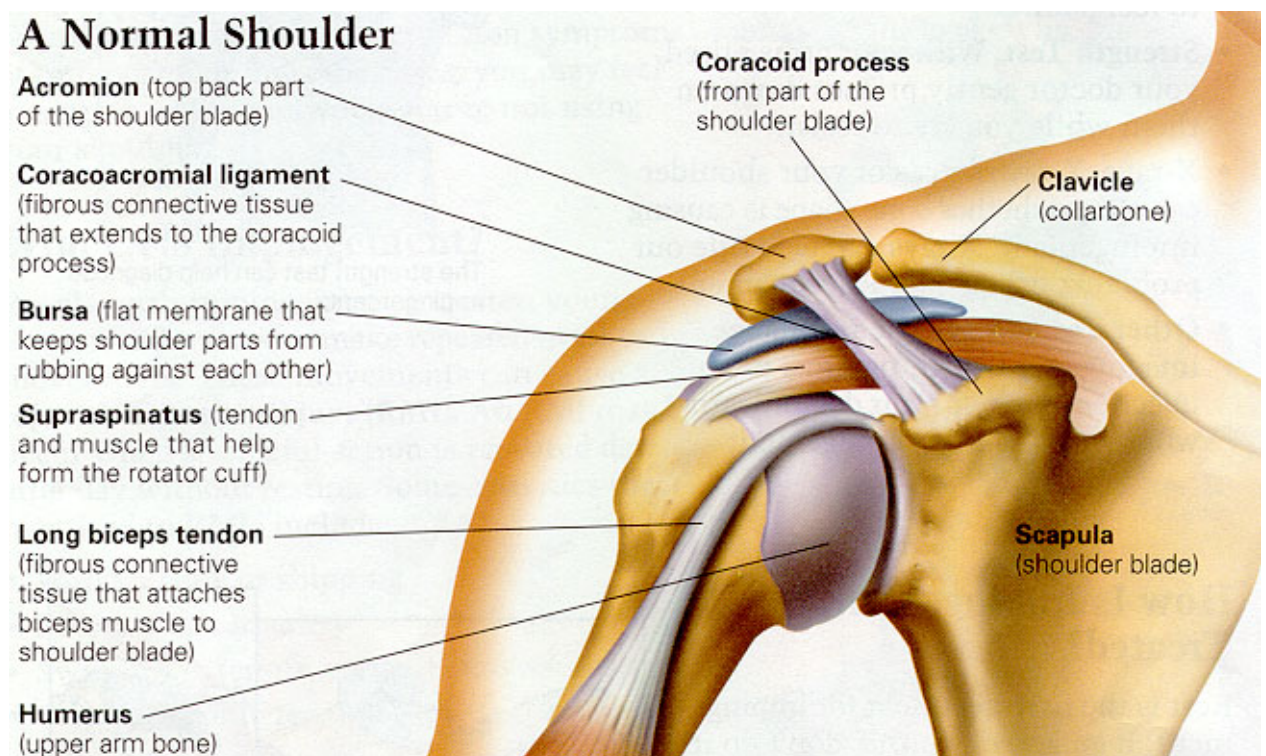
Mortality rates are significantly higher during the first year after injury than in the following years, especially for those who were severely injured, and the leading cause of death for SCI patients was renal failure. However, due to advances in urologic management, the leading causes of death have shifted to pneumonia, pulmonary emboli and septicemia. (Merck Manual, 2003; NSCID, 2005).

2.2 Overview of The Shoulder

2.2.1 Shoulder Anatomy

The shoulder joint consists of four articulations: the sternoclavicular joint, acromioclavicular joint, glenohumeral joint and scapulothoracic articulation (Sarrafiian,1983).

Figure (3) Shoulder Anatomy (Source: www.ortho-md.com/impingem.htm)



One side is round, and the other side is flat .The round side is called the humeral head, and the flat side is the glenoid. This comprises the shoulder joint. The bones that form the shoulder joint, because of their shape, do not provide much, if any, built in stability. The shoulder joint is a ball and socket joint and it is the most freely movable of the joints in the body (Watson, 2005).

The structures that do provide stability are the ligaments which surround the joint and are attached to the glenoid on one side and the humerus on the other side. These ligaments are most prominent in the front, underneath, and in the back of the joint. They are called the glenohumeral ligaments. There is also a thickened rim of

cartilage which surrounds the bony glenoid and acts to deepen the surface to more of a saucer (Longobardi, 2007).

This cartilage is called the glenoid labrum. On the top of the shoulder, there is a group of tendons attached to muscles which are called the rotator cuff. These tendons that make up the rotator cuff are not generally involved in a shoulder that dislocates, except in older individuals. Overuse of the shoulder, such as with pitching, can lead to irritation of the rotator cuff muscles and tendons as well as weakness. Some athletes that do a lot of throwing or participate in overhead racquet sports develop subluxation or instability secondary to these activities. They develop a tendonitis of the rotator cuff as it tries to compensate for the instability of the shoulder. In this group of patients, the initial treatment should be to strengthen the rotator cuff musculature, to use nonsteroidal anti-inflammatory drugs, and to rest. Failure to improve and to respond positively to this treatment may lead to surgical recommendation to correct the instability. The names of the muscles and tendons that comprise the rotator cuff are the subscapularis in the front or anterior, the biceps tendon in the front and top of the shoulder, the supraspinatus which is more or less on top, and the infraspinatus and teres minor which comprises the posterior or back. The ligaments which provide stability to the joint are actually underneath the cuff tendons. These muscles and tendons do support the shoulder, but their main function is to move the arm and shoulder. Again, the ligaments, anterior (front), inferior (bottom), and posterior (back), give the joint stability (Raphael Longobardi, 2007).

2.2.2 Shoulder Pain Caused by Wheelchair Propulsion

Manual wheelchairs (MWCs) are usually small and light, easy to transport, and maneuver well in confined spaces, but propulsion overtime is likely to increase injuries and pain in upper extremity especially in individuals with tetraplegia (Boninger et al., 1999).

Studies have shown that more than two thirds of individuals with SCI report suffering or having suffered from shoulder pain since the onset of using a MWC. In addition, upper limb pain as a result of MWC propulsion may occur as early as five years post injury (Sie et al., 1992).

A study conducted by Mulory and his colleagues (2004) to determine the influence of SCI level on shoulder muscle function during wheelchair propulsion, using Fine-wire electromyographic activity of 11 muscles recording during wheelchair propulsion in biomechanics research laboratory. They concluded that, the level of SCI significantly affected the shoulder muscle recruitment patterns during wheelchair propulsion. Differences in rotator cuff and pectoralis major function require specific considerations in rehabilitation program design.

Gellman and his colleagues (1988) studied the late complications of the weight-bearing upper extremity in the paraplegic patient and found that, eighty-four paraplegic patients whose injury level was T2 or below and who were at least one year from SCI were screened for upper extremity complaints. Fifty-seven (57.8%) had complaints of pain in one or more areas of their upper extremities. The most common complaints were shoulder pain and/or pain relating to carpal tunnel syndrome. Twenty-five (30%) complained of shoulder pain during transfer activities. Symptoms were found to increase with time from injury. As the long-term survival of spinal cord injured patients continues to improve, an increased awareness of the complications of the weight-bearing upper extremity is necessary to keep these patients functioning in society.

Sie and his colleagues (1992) conducted a study which addressed with a upper extremity pain in the post rehabilitation spinal cord injured patient, and reported that

the prevalence of shoulder pain is caused by many differences among the studies. They interviewed 239 individuals with SCI. They found that in people less than 5 years post-injury, 53 percent of individuals with tetraplegia and 16 percent of individuals with paraplegia reported shoulder pain. The difference between the groups is likely caused by neuropathic pain at the shoulder in tetraplegia. However, by 20 years post-injury, over 70 percent of individuals with paraplegia had pain, a higher percentage than those greater than 20 years post-injury, with tetraplegia. This increase in paraplegic shoulder pain likely represents repetitive strain injuries from years of transfers and manual wheelchair use.

When twenty wheelchair athletes with paraplegia, both with and without a rotator cuff impingement syndrome, were compared with regard to shoulder strength, the athletes with rotator cuff impingement exhibited decreased shoulder adduction and external and internal rotation strength and increased abduction to adduction and abduction to internal rotation strength ratios (Burnham et al., 1993).

Bayley and others (1987) studied ninety-four veterans with complete paraplegia. Each veteran had a physical examination focusing on the upper extremity. Thirty-one patients reported a history of shoulder pain, and twenty-three were found to have signs of impingement syndrome on examination. All twenty-three subjects with pain on examination had X-rays and arthrography that revealed rotator cuff tears in 65 percent and aseptic necrosis of the humeral head in 22 percent and they found that interarticular pressure was over two times arterial pressure when performing a transfer. They believed that this increased pressure stressed the vasculature of the rotator cuff tendon and led to injury.

Another study reviewed the medical and surgical records of fifty-one patients with SCI who were all more than 20 years post injury. Radiographic evidence of shoulder degenerative joint disease was found in 32 percent of these subjects. Patients with greater activity levels had less evidence of injury. 18 percent of active wheelchair users had joint space narrowing in the shoulder ,and felt that this joint space narrowing led to impingement of the rotator cuff. Muscle imbalance, caused by overuse, is thought to lead to abnormal biomechanics and thus injury (Wylie and Chakera, 1988).

In agreement with the study by Bayley et al., Esobedo and his group (1997) have looked at Magnetic Resonance Imaging(MRI) abnormalities in individuals with SCI and with average age of 59 years and the average number of years post-injury was 26, and found that 57 percent of veterans with paraplegia had rotator cuff tears, with the severity of tears related to age and duration of SCI.

More recent work by Boninger and his partners (2001) who conducted a study which addressed with shoulder imaging abnormalities in individuals with paraplegia and the average age of subjects was 59 years and years post-injury was 26. In the twenty-eight subjects tested (fifty-five shoulders), only a single rotator cuff tear was seen (regarding the average age of this study was 35 years and years post-injury was 11.5,and regarding the Esobedo study) ,and a relationship was seen between the number of imaging abnormalities and an individual's weight. This relationship was thought to be caused by the excess work and strain related to transfers and wheelchair propulsion caused by increased weight.

Osteolysis of the distal clavicle is another imaging abnormality noted in individuals with paralysis. Osteolysis of the distal clavicle is characterized by progressive resorption of the lateral end of the clavicle. As stated by Roach and Schweitzer (1997) osteolysis of the distal clavicle occur following spinal cord injury, and the most likely cause of this finding is repetitive trauma to the upper extremity caused by transfers and wheelchair propulsion.

2.3 Wheelchairs for SCI patients

Assistive mobility devices—including wheelchairs, canes, crutches, and walkers—are effective ways to alleviate the impact of mobility limitations for many people who are having spinal cord injury, permitting more efficient ambulation over long and short distances, increased independence and the promise of full participation in community life.

The most common mobility device which used by SCI patients, especially low level injured person is the wheelchair.

Wheelchairs are available in two basic types: manual and powered. Both types have some common components, including frames, seating systems, upholstery, brakes, wheels and tires, footrests, and armrests . A wheelchair can furnish wellness benefits and can aid to convey back or keep independency, and is easy to run and transport. In this current research the researcher will discuss the most common types of wheelchairs used in Gaza strip for SCI person.

(Source: <http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>)

2.3.1 Manual Wheelchairs

Manual wheelchairs are wheelchairs that are ‘powered’ either by the wheelchair user or by somebody pushing the wheelchair. Standard Wheelchairs, Folding Lightweight Wheelchairs, and Rigid Frame Wheelchairs are the most common types of manual wheelchairs. Special Positioning Wheelchairs, and Sports Chairs and Cycles are other types.

(Source: <http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>)

2.3.1.1 Standard Wheelchairs

Standard wheelchairs are the kind which it mainly see in hospitals. They are the most basic, least adjustable and heaviest of the wheelchairs. The main use of this type of chair is for transportation (figure 3). Because they are generic, they cannot be adjusted to fit the user and are difficult to maneuver independently .

(Source: <http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>) .

Figure(3) Standard Wheelchair. (Source: *Abledata Fact Sheet on Wheelchair For Children(2004). www.abledata.com*)



2.3.1.2 Lightweight Folding Wheelchairs

This type of folding wheelchair (meaning cross brace chair) is built with a lot more adjustment, is lighter weight (usually aluminum tubing) and is meant to provide decent independent mobility for the user. Because it is adjustable, the chair set up can be personalized to fit the user and can take a wide variety of accessories to provide the user postural support and comfort. While better than standard wheelchairs, this category of chair is still unlikely to meet the needs of someone with a SCI.

Ultra Lightweight Folding chairs are the most adjustable of the folding manual chairs and as a result the most maneuverable. For users requiring a cross brace folding chair for easy transportation(e.g. storage in the trunk of a car).

(Source:<http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>)

2.3.1.3 Rigid Manual Wheelchairs

The rigid manual wheelchair is specifically a “performance” focused chair. People with a SCI generally use this type if using a manual wheelchair. “Rigid” refers to the frame, which has no cross braces.

Often formed like a box, the tubes of the frame are welded together, providing the lightest possible frame with the least amount of structural flex. This makes the chair extremely strong and steady, and as a result, extremely maneuverable. While the finished product is not as adjustable as folding lightweight chairs, a lot more time is spent in assessing this wheelchair for the end user. Built to detailed specifications of the user, each chair is customized to fit the person who will use it. (Source: <http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>).

2.3.1.4 Special Positioning Wheelchairs

Another type of chair, generally not prescribed for consumers because it is rarely independently propelled, is the tilting, reclining or tilting and reclining manual wheelchair. This chair generally has a traditional wheelbase but is different in that the seat and back can be dynamically tilted to any angle. It has long been known that changing a person's position in space by tilting them shifts their weight, distributing pressure over the whole body surface and helping provide postural support to the user through gravity assistance.

Another type of specialty wheelchair is the stand-up chair. Available in both a manual and power version, this chair allows patients to sit and propel themselves as in any normal wheelchair, but a spring or motorized mechanism allows them to be stood up in the chair to take part in tasks or activities better performed standing (like playing golf). Expensive, heavy and not easily transported or stored, these chairs are often used in limited circumstances and usually as a secondary mobility device . (Source: <http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>) .

2.3.1.5 Special Terrain Wheelchairs

One last type of chair is the All-Terrain chair. The wheelchair world's equivalent to the Jeep, this chair can go just about anywhere and users usually stretch its abilities. Very rigid and much larger than most chairs, the All-Terrain chairs are rarely used as an everyday chair.

(Source:<http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>)

2.3.1.6 Sports Chairs and Cycles

Even more high performance versions of the rigid manual chair are available for use in active sports like wheelchair racing and basketball. Often users will use this type of chair for both sports activities and daily living, simply changing the wheels and configuration. Generally though, these are secondary chairs purchased for these specific activities.

Cycles are becoming very popular. These chairs have a kind of drag racer look being very low to the ground and capable of high speeds. Driven by hand cycling, they provide fun and exercise, though they are not practical for day to day use and funding rarely covers their cost.

(Source: <http://www.csro.com/assets/pdf/afterandbeyond/193-210.pdf>)

2.3.2 Power Wheelchairs

Electric Wheelchairs (power wheelchairs) are powered by motors and ideal for someone who needs to use a wheelchair continuously ,e.g. Rear wheel drive, Mid wheel drive ,and scooter.

Chapter Three

Literature Review

Chapter Three: Literature Review

For most people who have sustained a spinal cord injury, a wheelchair is their primary mode of ambulation. Mobility in a wheelchair is affected by a number of factors including the accessibility of the environment, the appropriateness of the wheelchair and the functional ability of the user.

Paraplegic patients (target population in this thesis) as one of the most common type of SCI have been trained to use wheelchairs for functional locomotion, activities of daily living and sports practice. Some wheelchairs users experience pain in upper limbs that interfere on essential daily activities, as when propelling the wheelchair itself, driving, dressing and performing transferences. Some of them reject to propel their wheelchairs by themselves and invite others to propel them due to pain in their upper extremities especially the shoulder .

While shoulder pain may not initially limit the wheelchair user's ability to perform activities independently, it may have functional costs such as rapid fatigue, loss of endurance, decreased speed or efficiency of movement, low tolerance for prolonged work or leisure activity and decreased cardiorespiratory endurance. Eventually wheelchair users with shoulder pain may eliminate functional activities that are associated with pain (Curtis et al., 1995).

This chapter discusses the literature review conducted on shoulder pain among SCI persons who are using manual wheelchairs.

3.1 Prevalence of Shoulder Pain among SCI Patients

Many studies have shown that more than two thirds of individuals with SCI reported suffering or having suffered from shoulder pain since the onset of using manual wheelchairs (MWC). In addition, upper limb pain as a result of MWC propulsion may occur as early as five years post injury (Sie et al., 1992).

A study conducted by Salisbury et al., (2006) titled with shoulder pain following tetraplegia: a follow-up study 2-4 years after injury which revealed that shoulder pain prevalence was 70%. Pain was associated with discharge motor level of C6-T1 ($P=0.003$). Pain was most commonly located in the shoulder joint.

Nichols and his both colleagues (1979) studied shoulder pain in patients with spinal cord lesions by distributing a questionnaire which was circulated to the 708 members of the Spinal Cord Injuries Association in 1976. The response rate was 79.5%. Over one half (51.4%) of the respondents suffered from shoulder pain, an incidence in excess of any age group in a control population derived from a general practitioner's register. The pain, which was related particularly to wheelchair usage and other attendant factors such as transfers, was in some instances clearly in the shoulder, whereas in others it was more likely to be cervical root pain.

In another study by Curtis and his colleagues (1999b) conducted on 55 women and 140 men, 92 subjects with tetraplegia and 103 subjects with paraplegia who met inclusion criteria of 3 hours per week of manual wheelchair use and at least 1 year since onset of spinal cord injury, it showed that more than two thirds of the sample reported shoulder pain since beginning wheelchair use, with 59% of the subjects with tetraplegia and 42% of the subjects with paraplegia reporting current pain.

Curtis and Black (1999) conducted a study to assess activity level, medical history, and the prevalence and intensity of shoulder and upper extremity pain experienced during functional activities in female athletes who compete in wheelchairs and they reported that only 14% of the subjects reported shoulder pain prior to wheelchair use. In contrast, 72% of the subjects reported shoulder pain since wheelchair use, with 52% reporting current shoulder pain.

Sawatzky et al., (2005) examined whether the prevalence of shoulder pain in adult wheelchair users who began using their wheelchairs during childhood is similar to those who began using their wheelchairs as adults and the results revealed that shoulder pain was greater in the adult-onset wheelchair users compared with the childhood-onset group ($p < 0.008$), even though their general lifestyles were not different. The immature skeleton can possibly respond to the repetitive forces of wheeling better than that of those who begin using a wheelchair once their skeletal structure is completely developed.

Another study compared the onset and prevalence of shoulder pain in athletic and nonathletic wheelchair users and the odds of having shoulder pain were twice as high among nonathletes as they were among athletes. This finding represents a significant difference over and above age differences, differences in years spent in a wheelchair, and differences in level of spinal cord injury. Athletes also have an average of 12 yr free of shoulder pain after becoming wheelchair bound, whereas nonathletes have only 8 yr. (Fullerton et al., 2003).

Finley and Rodgers (2004) investigated the prevalence and identity of shoulder pathology in athletic and nonathletic manual wheelchair users (MWCUs). Fifty-two MWCUs (26 athletes, 26 nonathletes) completed a survey regarding the nature of their injury, sports involvement, history, and presence of current and/or past shoulder pathology. Subjects currently experiencing shoulder pain underwent a clinical examination of both shoulders. No difference was found in the incidence of shoulder pain, past or present, between athletes and nonathletes. Collectively, 61.5% (32/52) of the subjects reported shoulder pain, with 29% reporting shoulder pain at the present time. Years since onset of disability ($p = 0.01$) and duration of wheelchair use ($p = 0.01$) were found to be greater in individuals who reported a history of shoulder pain. Of the painful shoulders tested, 44% revealed clinical signs and symptoms of rotator cuff impingement, while 50% revealed signs of biceps tendonitis. Instability was found in 28% of the painful shoulders. These findings indicate that involvement in athletics neither increases nor decreases the risk of shoulder pain in the manual wheelchair population. Bicipital tendonitis with impingement syndrome was the most common pathology.

A survey study was conducted by Gironda and his colleagues (2004) to examine the prevalence and intensity of pain and associated patient characteristics in a national sample of veterans with paraplegia. Of particular interest were upper limb (UL) pain conditions, which pose unique challenges to individuals who use a wheelchair for mobility. Because the risk for UL pain conditions appears to increase over time, the associations among age, duration of wheelchair use, and UL pain were evaluated. Approximately 81% of the respondents reported at least a minimal level of ongoing unspecified pain and 69% experienced current UL pain.

Another study reported that, 51% of persons with SCI have shoulder problems. Common shoulder problems in persons with spinal cord injury begin with muscle imbalance that can lead to glenohumeral instability, impingement disease, rotator cuff tears, and subsequent degenerative joint disease. These problems can be attributed to the functional demands placed on the shoulder that are specific to patients with SCI, including overhead activities, wheelchair use, and transfers. (Lee and McMahon, 2002)

Dalyan and his colleagues (1999) conducted a study to determine the frequency and severity of upper extremity pain as well as its association with functional activities. By data analysis of the 130 persons who responded, 76 (58.5%) (38 paraplegic, 38 tetraplegic patients) reported upper extremity pain: 71% had shoulder pain, 53% wrist pain, 43% hand pain, and 35% elbow pain. Pain interfered with transfers in 65% (36/55) of the patients who were doing them. Of ten functional activities, pain was more likely to be associated with pressure relief, transfers, and wheelchair mobility.

Another study indicated that, wrist and shoulder pain were more prevalent than previously indicated (72.7 percent of respondents reported some degree of chronic pain in one or both of these areas) (Subbarao et al., 1995).

3.2 Level of Manual Wheelchair Skill Performance and Participation

By cross-sectional study Kilken et al., (2005a) described the level of manual wheelchair skill performance and participation of persons with SCIs 1 year after discharge from inpatient rehabilitation and tests the hypothesis that wheelchair skill performance is positively related to participation. Participants included 81 persons with SCI from eight rehabilitation centers in the Netherlands. The Wheelchair Circuit consists of eight wheelchair skills and results in three test scores: ability, performance time, and physical strain. Participation was assessed with the sum of the subscales Mobility Range and Social Behavior of the 68-Item Sickness Impact Profile (SIPSOC). The regression analyses showed that, after controlling for lesion and personal characteristics, manual wheelchair skill performance is positively related to participation, with the strongest association for the performance time score. In persons with SCI who are manual wheelchair users, wheelchair skill performance is moderately associated to participation. Training of wheelchair skills has to be an important goal of rehabilitation, and persons should be stimulated to maintain their wheelchair skills after discharge from rehabilitation.

The patterns of movement and muscle activation in wheelchair ambulation have been studied by Schantz and his colleagues (1999) in two groups: subjects with paraplegia (n = 4) and tetraplegia (n = 3). The tests were done in the subjects' own wheelchairs and under free-wheeling conditions. The tasks studied were: self-chosen normal velocity, maximal velocity and maximally accelerated start. Muscle activation was registered by surface electromyography performed on several arm and shoulder muscles. The movement pattern was studied by goniometry of the shoulder and elbow joints, as well as by observing video recordings. Speed and arm cycle frequency were also recorded. The movement pattern was divided into three phases: pull, push and recovery. Relatively concordant muscle activation patterns were noted within the groups, whereas differences were noted between the groups with regard to muscle activation, length of the pull and push phases and the velocity-dependent adaptation. The subjects with tetraplegia were more dependent on the pull phase. The self-chosen normal and maximal speeds of the subjects with tetraplegia were approximately half those of the subjects with paraplegia. Three different types of recovery movements were noted as well as a velocity-dependent

adaptation. Major trunk movements during the rim phase were only noted at the maximally accelerated start.

In the other hand Killen et al., (2005b) studied the changes in wheelchair skills in subjects with SCI during rehabilitation; to determine whether changes in wheelchair skill performance are related to the subject, lesion characteristics, secondary complications, and upper extremity pain; and to investigate if wheelchair skill performance at discharge can be predicted from these features. Subjects performed the Wheelchair Circuit 3 times during rehabilitation: at admission (t1), 3 months later (t2), and at discharge (t3). And the results were as the following: all the scores of the Wheelchair Circuit improved significantly between t1 and t2, and between t2 and t3. The scores were related to age and lesion level, whereas changes in scores were related to age, sex, lesion level, and secondary complications. The variables age, body mass index, sex, lesion level, motor completeness, and secondary complications contributed significantly to the prediction of the scores at t3. these result mean wheelchair skill performance improved during rehabilitation. Personal and lesion characteristics are most important for improving wheelchair skill performance and predicting wheelchair skill performance.

The effects of SCI level on shoulder kinetics during manual wheelchair propulsion were studied by Kulig and his colleagues (2001) using single session data collection in a laboratory environment. Male subjects were divided into four groups: low level paraplegia (n=17), high level paraplegia (n=19), C7 tetraplegia (C7, n=16) and C6 tetraplegia (C6, n=17). Measurements were recorded using a six-camera VICON motion analysis system, a strain gauge instrumented wheel, and wheelchair ergometer. Shoulder joint forces and moments were calculated using the inverse dynamics approach. And they found mean self-selected propulsion velocity was higher in the paraplegic (low paraplegia=90.7 m/min; high paraplegia=83.4 m/min) than tetraplegic (C7=66.5 m/min; C6=47.0 m/min) groups, and no significant differences in shoulder joint moments were identified. However, superior push force in subjects with tetraplegia (C7=21.4 N; C6=9.3 N) was significantly higher than in those with high paraplegia (7.3 N), after covarying velocity.

But Newsam and his group (1999) compared three dimensional upper extremity motion during wheelchair propulsion in persons with 4 levels of spinal cord injury: low paraplegia (n=17), high paraplegia (n=19), C7 tetraplegia (n=16), and C6 tetraplegia (n=17). Upper extremity motion was recorded as subjects manually propelled a wheelchair mounted on a stationary ergometer. For all motions measured, subjects with paraplegia had similar patterns suggesting that the wheelchair backrest adequately stabilizes the trunk in the absence of abdominal musculature. Compared with paraplegic subjects, those with tetraplegia differed primarily in the strategy used to contact the wheel. This was most evident among subjects with C6 tetraplegia who had greater wrist extension and less forearm pronation .

3.3 Risk Factors Cause and Aggravate Shoulder Pain

Salisbury and his colleagues (2003) determined that the risk factors associated with pain during rehabilitation included age less than 30 years or more than 50 years, and found that no relationship existed between shoulder pain and functional motor skills on discharge.

In another study for Salisbury, and two of researchers (2006), found that pain was primarily aggravated by movement and cold weather and relieved by rest and the most painful activity was lifting an object from overhead. Quality of life was affected by pain in 68.4% of participants.

Samuelsson et al., (2004) reported that the consequences of shoulder pain in paraplegic wheelchair users are mostly related to wheelchair activities. Since the wheelchair use itself presumably cause shoulder problems, this will become a vicious circle.

Shoulder pain intensity was most severe during the performance of wheelchair related mobility and transportation activities, suggesting that upper limbs pain may have a significant impact on functional independence. Duration of wheelchair use modestly predicted shoulder pain prevalence and intensity, but age and the interaction between age and duration of wheelchair use did not (Gironde et al., 2004).

The study purpose which conducted by Gutierrez and his colleagues (2007) aimed to identify the relationship of self-reported shoulder pain with quality of life, physical activity, and community activities in persons with paraplegia resulting from SCI. and they found that, persons with SCI who reported lower subjective quality of life and physical activity scores experienced significantly higher levels of shoulder pain. However, shoulder pain intensity did not relate to involvement in general community activities. Attention to and interventions for shoulder pain in persons with SCI may improve their overall quality of life and physical activity.

Subbarao and his colleagues (1995) designed a study to determine which activities caused or exacerbated the pain, and assessed functional and emotional responses to chronic pain and found that wheelchair propulsion and transfers caused most pain and also increased the degree of pain. Patient's age, neurologic level and time since injury were not statistically significant in the study and emotional responses did not significantly vary between groups with and without pain. But Curtis and Black (1999) determined the highest intensity of shoulder pain was reported during household chores, propulsion on ramps or inclines, lifting overhead, and while sleeping.

A cross-sectional study for seventy wheelchair users with SCI were asked 5 questions within each setting (home, community, transportation) related to their perceived reason for functional limitations. The answers of subjects revealed that the wheelchair was the most commonly cited factor limiting participation, followed by physical impairment and physical environment. Twenty-one percent of subjects with paraplegia reported pain as a limiting factor for their transportation use, significantly more than subjects with tetraplegia (3%). A trend was seen toward a higher percentage of subjects with tetraplegia (tetraplegia, 7%; paraplegia, 3%) reporting lack of equipment as a limiting factor for use of transportation. Differences were also seen across sites (Chaves et al., 2004).

McCasland and his colleagues (2006) conducted a study to identify the risk factors associated with shoulder pain in the traumatic spinal cord injury (TSCI) population. A telephone survey and medical record review were conducted on a convenience sample of patients with TSCI. Data variables included: Shoulder Pain and Disability Index (SPADI), demographics, injury type, treatment histories for shoulder pain/dysfunction, assistive device use, and radiographic imaging. The majority of patients (70%) currently had shoulder pain, one third had previous injury to the shoulder, and 52% reported bilateral pain. Tetraplegics had higher prevalence (80%) of shoulder pain and higher total SPADI scores than paraplegics. Previous shoulder trauma increased the likelihood of shoulder pain. Self-care posed their most difficult task. Use of a manual wheelchair (71%) and/or trapeze bar (51%) was common. However, no differences were found in wheelchair or trapeze bar use or average body mass index between groups with and without pain.

Respondents with pain tended to use trapeze bars less. Of the respondents reporting shoulder pain, an estimated 57% received physical therapy and massage with most reporting some benefit; 53% had pharmaceutical treatment with variable effect .

Information from Lal study (1998) is expected to assist in identification of high risk SCI individuals, and ultimately in development of preventive strategies. The shoulders of 53 spinal cord injury patients from the onset of injury until 15 years duration were subjected to clinical and radiological examination at the Rehabilitation Institute of Chicago. Thirty-eight out of 53 (72%) patients demonstrated radiological evidence of degenerative changes, but only six (11%) complained of pain in the shoulders. This study demonstrated a correlation between individuals with higher level of wheelchair activity (72%), higher age (92% above and 8% less than 30 years) and female gender (89% females versus 65% males) more prone to develop degenerative changes in the shoulders. Acromioclavicular joint was predominantly affected .

A longitudinal study is conducted to determine if shoulder pain and range-of-motion (ROM) problems can be predicted by demographic, injury-related, body weight, and radiographic data over 3 years and to determine the relationships among these shoulder problems and functional limitations, disability, and perceived health. Eighty-nine adult men with TSCI were included in the study. The Acromioclavicular (AC) and the glenohumeral (GH) joints were x-rayed on plain film in standard anteroposterior position. Functional limitations were determined with the Functional Independence Measurement (FIM) instrument; disability was measured with the Craig Handicap Assessment and Reporting Technique (CHART). Thirty percent had shoulder pain and 22% had shoulder ROM problems. Men with shoulder pain had lived longer with SCI, were more likely to report shoulder ROM problems, had lower CHART mobility scores, and were more likely to rate their health as fair than those without shoulder pain. Shoulder ROM problems were more common among men who were older, had AC joint narrowing, had lower FIM scores, and reported poorer health (Ballinger et al., 2000)

After SCI ,excessive burden falls on the upper extremity, especially the shoulder. Overall, 51% of persons with spinal cord injury have shoulder problems. Common shoulder problems in persons with spinal cord injury begin with muscle

imbalance that can lead to glenohumeral instability, impingement disease, rotator cuff tears, and subsequent degenerative joint disease. These problems can be attributed to the functional demands placed on the shoulder that are specific to patients with spinal cord injury, including overhead activities, wheelchair use, and transfers. Despite preventive exercises, shoulder problems in persons with spinal cord injury remain a significant problem, causing pain and functional limitations. The biomechanics of the shoulder for persons with spinal cord injury resulting from changes in muscle plasticity will be elucidated. Specifically, the effects of scapular protraction that can result from muscle imbalance, the age-dependent properties of the anterior band of the inferior glenohumeral ligament, and the influence of the dynamic restraints around the shoulder will be addressed.(Lee and McMahon,2002).

Veeger et al., (2002) assessed the mechanical load on the GH joint and on shoulder muscles during wheelchair propulsion at everyday intensities. Three experienced wheelchair users underwent wheelchair exercise tests at combinations of two load levels (10 and 20W) and two velocities (0.83 and 1:39 m_s_1) during which input data were collected for a musculoskeletal model of the upper extremity. The model was then used for the estimation of the glenohumeral contact force, as well as individual muscle forces. And the results were as the following: Low intensity wheelchair propulsion does not appear to lead to high contact forces. The muscle forces in the rotator cuff and especially in the m. supraspinatus are high. This might indicate a risk for muscle damage and the subsequent development of shoulder complaints, such as rotator cuff tears.

3.4 Effects of Interventions to decrease Shoulder Pain

A study conducted by Van Drongelen et al., (2006) to study upper extremity musculoskeletal pain during and after rehabilitation in wheelchair-using subjects with SCI and its relation with lesion characteristics, muscle strength and functional outcome, they found that upper extremity pain and shoulder pain decreased over time (30%) during the latter part of in-patient rehabilitation. Subjects with tetraplegia showed more musculoskeletal pain than subjects with paraplegia . Upper extremity pain and shoulder pain were significantly inversely related to functional outcome. Muscle strength was significantly inversely related to shoulder pain. Musculoskeletal pain at the beginning of rehabilitation and BMI were strong predictors for pain 1 year after in-patient rehabilitation.

Nawoczenski et al., (2006) conducted a study to determine the effects of a controlled 8-week, scapula-focused exercise intervention on pain and functional disability in people with SCI and shoulder impingement symptoms. The study revealed subjects in the intervention group showed significant improvements in all measures as a result of the intervention, whereas asymptomatic control group subjects remained stable.

But Curtis and his colleagues (1999a) conducted a study to analyze the effectiveness of a 6-month exercise protocol on shoulder pain experienced by wheelchair users during functional activities and found that 75% of the subjects reported a history of shoulder pain since beginning wheelchair use.

Dyson-Hudson et al., (2001) studied the effectiveness of acupuncture and Trager Psychophysical Integration (a form of manual therapy) in decreasing chronic shoulder pain in wheelchair users with SCI and found that Acupuncture and Trager are both effective treatments for reducing chronic shoulder pain associated with functional activities in persons with SCI.

A study review reported that an estimated 90% of all wheelchairs are hand-rim propelled, a physically straining form of ambulation that can lead to repetitive strain injuries in the arms and, eventually, to secondary impairments and disability. Further disability in wheelchair-dependent individuals can lead to a sedentary lifestyle and thereby create a greater risk for cardiovascular problems. Studies on lever-propelled and crank-propelled wheelchairs have shown that these propulsion mechanisms are less straining and more efficient than hand-rim-propelled wheelchairs. This article reviews these studies and substantiates that the frequent use of these alternative propulsion mechanisms may help prevent some of the secondary impairments that are seen among today's wheelchair-user population (Van Der Woude et al., 2001).

Another study found that incidence of upper-limb overuse injuries among the manual wheelchair population has been found to be associated with hand-rim loading characteristics such as impact and peak loading on the hand rim during propulsion and proposed one method to reduce impact and peak loading is the use of a compliant hand rim, one that can displace relative to the wheel when impacted by the hand. A Variable Compliance Hand-Rim Prototype was designed and used to experimentally optimize the level of compliance through subjective and qualitative propulsion outcome measures. No adverse biomechanical side effects to compliance were found. As compliance was increased, user acceptance decreased. All the subjects found the lowest level of compliance (C1) to be acceptable. Use of the C1 hand rim significantly reduced the peak rate of rise in the hand-rim force on the 6% and 8% grades and significantly reduced the average rate of loading for the 2%, 4%, and 6% grades (Richter and Axelson, 2005).

One of the objectives of Dalyan et al., study (1999) was to identify types of treatments that SCI patients received for upper extremity pain and the benefits of these treatments were also identified and found that 63% sought medical treatment for pain, and of those, 90% received either physical therapy, pharmacological treatment or massage. Although only 27% had wheelchair or home modification or joint protection education, these approaches were helpful for almost all and very helpful or extremely helpful in 26.6% and 63.6% of the patients, respectively .

Koontz and his colleagues (2006) was to examine the effect of an ergonomic wheelchair handrim as an intervention designed to reduce pain in the hands and wrists and improve functional outcomes for manual wheelchair users. Three studies were conducted to achieve this objective. In the first study, 10 individuals with paraplegia underwent a biomechanical analysis before and after a 2-week practice period with a Natural-Fit (NF) prototype ergonomic handrim. The biomechanical results showed that grip moments were reduced with the NF handrim prototype as compared with the subjects' current handrim. Other biomechanical findings were mixed. In the second study, 46 manual wheelchair users who replaced their standard handrim with the commercially available NF handrim completed a questionnaire of retrospective measures of symptom severity. Average duration of use of the NF was 6 months. When asked to compare propelling with the NF to propelling with their prior handrims, 85% of respondents reported less pain in their hands and 80% reported less pain in their wrists. The third study was a replication and extension of Study 2: 82 manual wheelchair users who replaced their standard handrim with the NF completed retrospective symptom severity and functional status scales after using the NF for an average of 9 months.

Functional and emotional responses to chronic pain was assessed and identifying ways in which the pain might be reduced, and study showed that among the pain group, various routine therapies were not effective and concluded that alternative methods for wheelchair propulsion and transfers, which lessen stress and cumulative trauma, need to be developed for SCI patients in order to diminish the incidence of chronic upper limb pain (Subbarao et al., 1995).

Finley and Rodgers (2007) conducted a study to investigate the impact of a manual 2-gear drive wheelchair wheel (MAGIC Wheels) on shoulder pain and function in manual wheelchair users. The participants in this study were full-time manual wheelchair users (N=17) currently experiencing shoulder pain (mean age, 46+/-14 y; wheelchair use, 15+/-10 y), and for Five-month trial using a 2-gear wheelchair wheel, using the Wheelchair Users Shoulder Pain Index (WUSPI), Wheelchair Users Functional Assessment (WUFA), and timed hill climb test with rating of perceived exertion. They found the following results: there was significant

reduction in shoulder pain after the intervention at week 2 through week 16. The difference was not found at week 20; however, 1 participant reported an increase in pain from unrelated factors during week 20. Change from baseline was calculated without this subject's data; there was a significant reduction in shoulder pain . There was no difference in WUFA after using the 2-gear wheel. Hill climb time was longer when using the 2-gear wheel , but no difference in the RPE resulted. Shoulder pain during the 4-week retention phase showed a trend toward increasing, as indicated by increased WUSPI scores.

2.3.4 Studies Conducted Concerning Wheelchairs

Most individuals with SCI, regardless of their levels of injury, rely on mobility devices such as wheelchairs as their primary means of mobility. Individuals with paraplegia are usually capable of propelling manual wheelchairs (MWCs) due to good strength in the upper body.

The National Health Interview Survey on Disability reported in 1999 that more than 2.3 million individuals in united states have disabilities requiring the use of a wheelchair (National Health Interview Survey on Disability,1999).

Currently, there is no specialized department in the MOH that deals with a comprehensive wheelchair service including assessment, prescription, fitting, education,, and follow up. Therefore wheelchairs are generally donated directly from charitable societies and organizations which do not have the capacity to do comprehensive wheelchair prescription and follow up.

Inappropriate wheelchairs often lead to potentially dangerous secondary complications such as scoliosis , pressure sores and shoulder pain. Having the right wheelchair can literally change the life of a poor or disadvantaged person with a disability by giving them greater independence, confidence and dignity. It can often provide them with their first access to earn their livelihood or be educated.

Hunt and his colleagues (2004) conducted a study in thirteen Model Spinal Cord Injury Systems that provide comprehensive rehabilitation for people with traumatic SCI and that are part of the national database funded through the US Department of Education to describe demographic variations in wheelchair provision for individuals with SCI in the general population, and found the following: Ninety-seven percent of manual wheelchair users and 54% of power wheelchair users had customizable wheelchairs. No power wheelchair user received a wheelchair without programmable controls. Minorities with low socioeconomic backgrounds (low income, Medicaid/Medicare recipients, less educated) were more likely to have standard manual and standard programmable power wheelchairs. Older subjects were also more likely to have standard programmable power .

In another study Fitzgerald and his colleagues (2001) examined 3 types of manual wheelchairs-ultralight wheelchairs (UWs), lightweight wheelchairs (LWs), and depot wheelchairs (DWs)-and compared the fatigue life between the wheelchair types. Wheelchairs were examined for differences in fatigue life based on equivalent cycles. Unique survival curves were fit and compared for each wheelchair type. The results were that the UWs lasted the longest, with a mean of 309,362 equivalent cycles. The DWs fared the worst, with a mean of 117,210 equivalent cycles. The Kaplan-Meier survival curves were significantly different ($p < .001$), with the UWs having the longest fatigue life .

A more recent pilot study which conducted by Fitzgerald and his colleagues (2005) to assess wheelchair durability and its effect on user satisfaction. Specifically, they examined the characteristics of the participants' wheelchairs, the types of maintenance and repairs completed, and whether the participants' satisfaction was affected by problems with their wheelchairs. A convenience sample of 130 participants who used wheelchairs as their primary means of mobility was recruited. Participants completed a questionnaire about their wheelchairs, the maintenance and repair history, and their satisfaction levels. Results showed that 26% of the participants had completed a wheelchair repair in the past 6 months, 16% had completed general maintenance, and 27% had completed tire repairs. Neither hours of wheelchair use nor wheelchair age affected repair or maintenance frequency. Participants were generally satisfied with their

wheelchairs. Better understanding of wheelchair maintenance and repair issues will guide improvements in wheelchair design and enhance the community participation of individuals who use wheelchairs .

A cross-sectional survey addressed mobility aids and transport possibilities was conducted. Demographic data including, date of birth, gender, time of SCI, cause of SCI, neurological level and functional classification from medical files were combined with information concerning mobility aids and transport possibilities at the time of follow-up from a mailed questionnaire for individuals with traumatic SCI. 236 subjects answered the questionnaire. In all, 126 were paraplegic and 110 tetraplegics. 3.4% of them used no special mobility aids at all. In total, 49 used crutches or rolling walkers and 26 lower extremities bracing, but mostly in combination with a wheelchair. Standing frame and stand-up wheelchair were used by men only. Manual wheelchair was used by 83.5% and electrical wheelchair used by 27%, and the latter used more by the tetraplegics. In all, 9.3% had neither a manual nor an electrical wheelchair. Overall, 86.4% had a passenger van or another mobility car. Women used a car less often. Passenger vans were more often used by tetraplegics (Biering-Sørensen et al., 2004).

A national survey study of providers of pediatric powered wheelchairs was conducted to collect background data on these professionals and to develop a "model" of their current assessment and recommendation practices. Data collected in the survey included provider demographics, frequency of powered wheelchair provision to young children, common reasons for not recommending a powered wheelchair, reasons why a child who is recommended a powered wheelchair does not receive one, current pediatric powered wheelchair assessment and recommendation practices, and subjective data regarding the efficacy of these practices and the impact of powered wheelchairs on children. These activities were then combined into common "factors" using factor analysis. A total of 140 surveys were received from providers in 46 American states. Of these providers, 54% were clinicians (e.g., physical therapists, occupational therapists), and 46% were suppliers (e.g., Rehabilitation Technology Specialists). The 3 major reasons for not recommending a powered wheelchair included cognitive, physical, and behavioral barriers. The 3 major reasons why a child who is recommended a powered

wheelchair does not receive one included funding issues, lack of family support, and transportation issues (Guerette et al., 2005)

A research was conducted to investigate whether home accommodations influence the amount of human help provided to a nationally representative sample of adults who use wheelchairs. The analytic sample consisted of 899 adults aged 18 and older who reported using wheelchairs in the previous 2 weeks. Home accommodations were related to the receipt of unpaid, but not paid, help. Relative to having no home accommodations, the presence of each additional accommodation decreased the odds of having unpaid help by 14%. Additionally, they observed an inverse relationship between the number of accommodations in the home and hours of unpaid help ($p < .01$). For wheelchair users who live alone, specific types of home accommodations were also inversely related to hours of unpaid help (Allen et al., 2006).

3.5 Summary of literature

Several literatures have specifically studied the shoulder pain among SCI persons, and some of these literatures reported shoulder pain among those persons ranged between 30% to 70%.

Training of wheelchair skills has to be an important role of rehabilitation, and some studies found that personal and lesion characteristics are most important for improving wheelchair skill performance and predicting wheelchair skill performance .

The studies found many factors cause shoulder pain like some activities (lifting an objects over head, activities due to wheelchair propulsion or ADLs), but varied in their results about the most activity cause shoulder pain.

Some studies found no relationship between age, time of injury, and neurological level with shoulder pain, and other studies found a relationship .

Many studies was varied in treatment options from physical and pharmaceutical interventions to relieve pain. Other researchers have tried to modify

the wheelchair to show the results of improvement from shoulder pain caused by wheelchair.

Chapter Four

Materials and Methods

Chapter Four : Materials and Methods

This chapter describes the materials and methods that was used in this research. The adopted methodology to accomplish this study used the following techniques: review of literature related to main subject, the information about the research plan and design, research population, study setting and its period, questionnaire design and content, statistical data analysis, content validity, and pilot study.

4.1 Research Plan and Design

The first phase of the research thesis proposed identifying and defining the problems and establishment objective of the study and development research plan.

The second phase of the research included a summary of the comprehensive literature review. Literatures related to shoulder pain among rehabilitated paraplegic spinal cord-injured persons were reviewed.

The third phase of the research included a field survey which was conducted with Shoulder Pain, also some actual claims cases were collected during the field survey.

The fourth phase of the research focused on the modification of the questionnaire design, through distributing the questionnaire to pilot study ,and the questionnaire was modified based on the results of the pilot study.

The fifth phase of the research focused on interviewing the subjects to collect the data by using the questionnaire. This questionnaire was used to collect the required data in order to achieve the research objective.

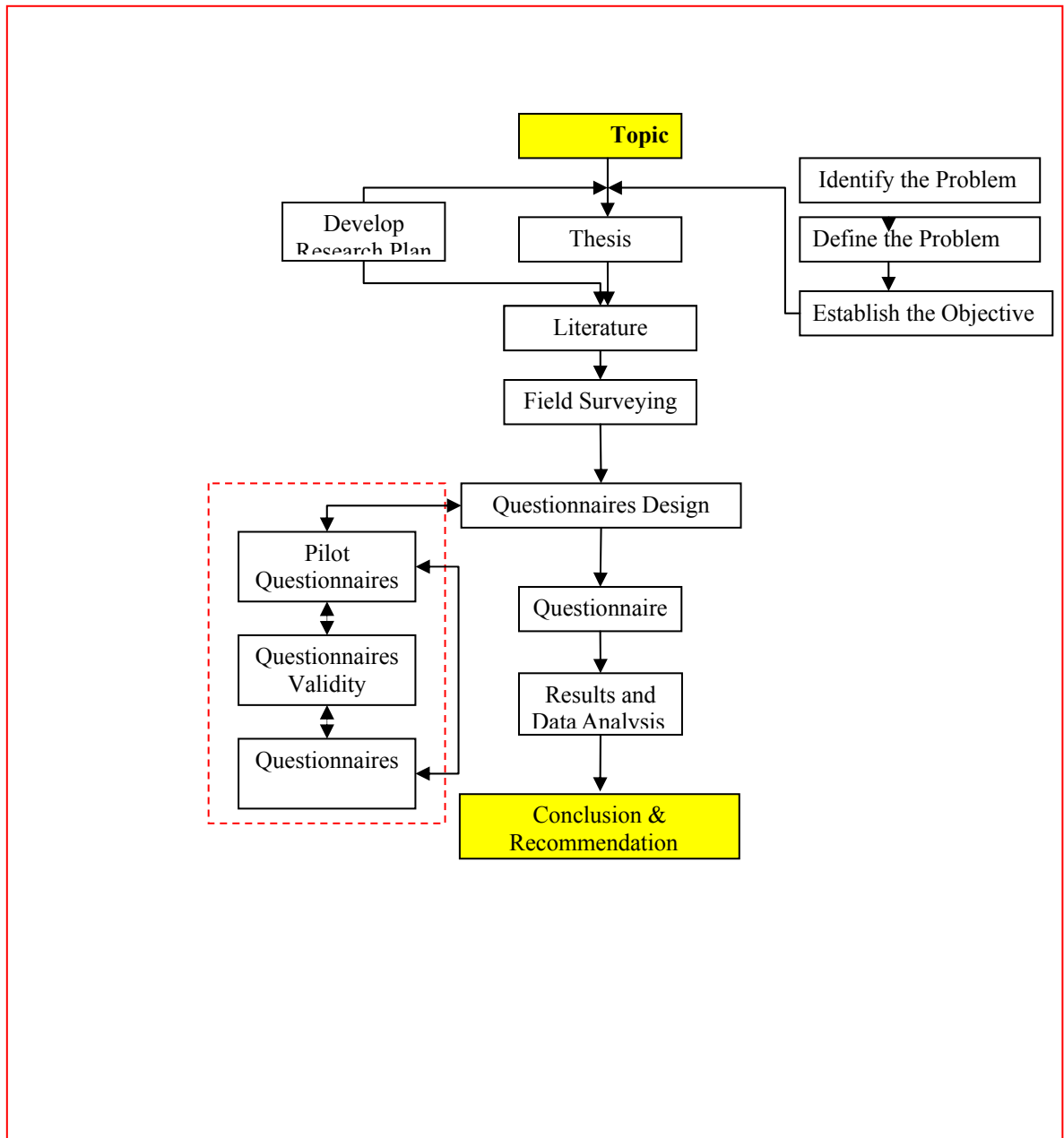
The sixth phase of the research was data analysis and discussion, and the final phase includes the conclusions and recommendations.

Figure (8) shows the methodology flowchart, which leads to achieve the research objectives.

Cross sectional survey study design was carried out to establish the objectives of this study.

Cross sectional studies are relatively quick and economic processes to conduct where the researcher's time and resources are limited (Pilot and Hungler, 1999).

Figure (4) The Methodology Flow Chart.



4.2 Research Population

The population for this study consisted of adult males and females paraplegics manual wheelchairs users with traumatic and nontraumatic SCI.

Subjects were recruited from El Wafa Medical Rehabilitation Hospital archive. A total of 123 subjects were recruited and gave informed consent to participate in this study. 30 subjects for piloting and then excluded from the study. The total subjects who responded to the study were 80 subjects ,9 did not respond and 4 were excluded from the study because they did not meet the criteria of inclusion.

Each individual was interviewed at his home personally by the researcher.

4.3 The Inclusion Criteria

- Male and Female patients with traumatic or nontraumatic spinal cord injury (paraplegics).
- Age: 18 -59 year old.
- Should have been rehabilitated for at least 2 weeks in an inpatient center.
- Have finished his rehabilitation period at least before six month prior to this Research.
- Manual propelled wheelchair users.

4.4 The Exclusion Criteria

- Paraplegics with progressive diseases.
- Paraplegic with psychiatric or mental problems.
- Subjects who were able to walk or use walker.
- Patients below 18 years and above 60 years.
- Paraplegics who still hospitalized for rehabilitation.
- Patients with other previous bone disease or Rheumatologic disorders.

4.5 Questionnaire Design and Content

After reviewing the literature and after interviewing experts who were dealing with similar subject at different levels, all the information that could help in achieving the study objectives were collected, reviewed and formalized to be suitable for the study survey. After many stages of brain storming, consulting, amending, and reviewing executed by the researcher with the supervisor, a questionnaire was designed into closed ended questions.

The questionnaire was translated into Arabic language (Annex 2) by the researcher, then sent to a specialist in English translation and after that the Arabic version sent to a specialist in Arabic for accreditation, and finally back translation to English was done. An English version is attached in (Annex 4).

Unnecessary personal data, complex and duplicated questions were avoided. The questionnaire was provided with a covering letter which explained the purpose of the study, the way of responding, the aim of the research and the security of the information in order to encourage high response.

The questionnaire design composed of three sections to accomplish the objectives of the research, as follows:

1. The first section contained **Demographic data**: as age, gender, educational level, period of inpatient rehabilitation, occupation,...etc
2. The second section contained the **Wheelchair User's Shoulder Pain Index**: The Wheelchair User's Shoulder Pain Index (WUSPI), a reliable and valid 15-item questionnaire, was developed specifically for manual wheelchair users who are functionally independent (curtis et al., 1995). It measures how shoulder pain has interfered with different daily activities, such as transferring, wheeling, and self-care. Each item is scored from 0 to 10, with 10 representing shoulder pain that has completely interfered with the activity during the past week. One derives a total score by adding the item scores and dividing by a possible total of 10 for each item answered.

3. The third section **Shoulder Rating Questionnaire**: The SRQ is an outcome tool that is more typically used in the general orthopedic setting. The SRQ overall score reflects the severity of symptoms and the functional status of the shoulder and comprises various domains: global assessment, pain, daily activities, recreational and athletic activities, and work. This tool is valid and reliable (L'Insalata et al., 1997). The satisfaction score, used as the third outcome measure in this scale, is an additional item in the SRQ .

4.6 Study Setting and Period of Study

The study carried out in Gaza Strip (in the five governorates: North, Gaza, Middle, Khan Younis, and Rafah), and the subjects were interviewed at their homes. The study carried out between the period of 25th, October, 2007 until 7th, January, 2008.

4.7 Ethical consideration and Procedure

Each participant was given an informed consent in Arabic (Annex 1). Each subject read an information letter about the study purpose and objectives added to each questionnaire, the names are not shown (anonymous), and confidential.

4.8 Piloting the Instrument

It is customary practice that the survey instrument should be piloted to measure its validity and reliability, and test the collected data. The purpose of the pilot study was to test and prove that the questionnaire questions are clear to be answered in a way that help to achieve the target of the study. In addition, it was important to ensure that all information received from the experts would be useful in achieving the research objective.

The pilot study was conducted by distributing the prepared questionnaire to panels of experts who have experience in the same field of the research to have their remarks on the questionnaire.

Tens representing, two panels were contacted to assess the questionnaire validity. The first panel, which consisted of eight experts (six of them returned the questionnaires), was asked to verify the validity of the questionnaire topics and its relevance to the research objectives. The second panel, which consisted of two experts in statistics, was asked to identify that the instrument used was valid statistically and that the questionnaire was well designed enough to provide relations and tests among variables.

Experts comments and suggestions were collected and evaluated carefully. All the suggested comments and modifications were discussed with the study's supervisors before taking them into consideration.

At the end of this process, some minor changes ,language modifications concerning the questions translation from English to Arabic and some additions were introduced to the questions and the final questionnaire was constructed for the main study.

4.9 Validity of the Questionnaire

Validity refers to the degree to which an instrument measures what it is supposed to be measured (Pilot and Hungler, 1999) .Validity has a number of different aspects and assessment approaches. There are two ways to evaluate instrument validity: content validity, and statistical validity, which include criterion-related validity, and construct validity.

4.9.1 Content Validity of the Questionnaire

Content validity test was conducted by consulting two groups of experts. The first was requested to evaluate and identify whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem.

The other was requested to evaluate that the instrument used is statistically valid and that the questionnaire was designed well enough to provide relations and tests between variables. The two groups of experts did agree that the questionnaire

was valid and suitable enough to measure the concept of interest with some amendments.

4.9.2 Statistical Validity of the Questionnaire

To insure the validity of the questionnaire, we used a Criterion-related validity test (Spearman test) which measure the correlation coefficient between each paragraph in one field and the whole field.

4.9.3 Criterion Related Validity

Internal consistency of the questionnaire is measured by a scouting sample, which consisted of thirty patients through measuring the correlation coefficients between each paragraph in one field and the whole field.

The tables (1) and table (2) show the correlation coefficient and p-value for each field paragraph. The p- values are less than 0.05 or 0.01, so the correlation coefficients of this field are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table (1) Spearman coefficient correlations(Wheelchair User’s Shoulder Pain Index)

Item No.	Paragraph	Spearman coefficient	p-value	Significance / Not Significance
<i>During the past week, how much shoulder pain did you experience when</i>				
1	Transferring from a bed to a wheelchair?	0.556	0.005	**
2	Transferring from a wheelchair to a car?	0.602	0.002	**
3	Transferring from a wheelchair to the tub or shower?	0.456	0.025	*
4	Loading your wheelchair into a car?	0.515	0.011	*
5	Pushing your chair for 10 min or more?	0.672	0.000	**
6	Pushing up ramps or inclines outdoors?	0.621	0.001	**
7	Lifting objects down from an overhead shelf?	0.526	0.008	**
8	Putting on pants?	0.564	0.003	**
9	Putting on a T-shirt or pullover?	0.653	0.001	**
10	Putting on a button-down shirt?	0.416	0.043	*
11	Washing your back?	0.588	0.003	**
12	Performing usual daily activities at work or school?	0.442	0.031	*
13	Driving?	0.410	0.042	*
14	Performing household chores?	0.487	0.016	*
15	Sleeping?	0.590	0.002	**

* Correlation coefficient is significant at the $\alpha = 0.05$

** Correlation coefficient is significant at the $\alpha = 0.01$

Table(2)Spearman coefficient correlations(Shoulder Rating Questionnaire)

Item No.	Paragraph	Spearman coefficient	p-value	Significance / Not Significance
1	Considering all the ways that your shoulder affects you, circle a number on the scale below for how well you are doing.	0.422	0.036	**

2	During the past month, how would you describe the usual pain in your shoulder at rest?	0.423	0.039	**
3	During the past month, how would you describe the usual pain in your shoulder during activities?	0.741	0.000	*
4	During the past month, how often did the pain in your shoulder make it difficult for you to sleep at night?	0.591	0.002	*
5	During the past month, how often have you had severe pain in your shoulder?	0.401	0.047	*
6	Considering all the ways you use your shoulder during daily personal and household activities (e.g., dressing, washing, driving, household chores), how would you describe your ability to use your shoulder?	0.659	0.000	**
7	Putting on or removing a pullover sweater or shirt	0.609	0.001	**
8	Combing or brushing your hair	0.404	0.045	*
9	Reaching shelves that are above your head	0.422	0.036	*
10	Scratching or washing your lower back with your hand	0.404	0.045	*
11	Lifting or carrying a full bag of groceries (8–10 lb)	0.577	0.003	**
12	Considering all the ways you use your shoulder during recreational or athletic activities (e.g. baseball, golf, aerobics, gardening), how would you describe the function of your shoulder?	0.477	0.016	*
13	During the past month, how much difficulty have you had throwing a ball overhand or serving in tennis due to your shoulder?	0.407	0.043	*
14	List one activity (recreational or athletic) that you particularly enjoy and then select the degree of limitation you have, if any, due to your shoulder	0.439	0.028	*
15	During the past month, what has been your main form of work?	0.469	0.018	*
16	During the past month, how often were you unable to do any of your usual work because of your shoulder?	0.587	0.002	**
17	During the past month, on the days that you did work, how often were you unable to do your work as carefully or as efficiently as you would like because of your shoulder?	0.644	0.001	**
18	During the past month, on the days that you did work, how often did you have to work a shorter day because of your shoulder?	0.784	0.000	**
19	During the past month, on the days that you did work, how often did you have to change the way that your usual work is done because of your shoulder?	0.501	0.011	*
20	During the past month, how would you rate your overall degree of satisfaction with your shoulder?	0.538	0.006	**

* Correlation coefficient is significant at the $\alpha = 0.05$

** Correlation coefficient is significant at the $\alpha = 0.01$

4.10 Reliability of the Questionnaire

The reliability of an instrument is the degree of consistency which measures the attribute; it is supposed to be measured (Pilot and Hungler, 1999). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability.

Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient.

It is difficult to return the scouting sample of the questionnaire-that is used to measure the questionnaire validity to the same respondents due to the different work conditions of this samples. Therefore two tests can be applied to the scouting sample in order to measure the consistency of the questionnaire. The first test is the Half Split Method and the second is Cronbach's Coefficient Alpha.

4.10.1 Split Half Technique

This method depends on finding Pearson correlation coefficient between the means of odd questions and even questions of each field of the questionnaire. Then, correcting the Pearson correlation coefficients can be done by using Spearman Brown correlation coefficient of correction.

The corrected correlation coefficient (consistency coefficient) is computed according to the following equation :

Consistency coefficient = $2r/(r+1)$, where r is the Pearson correlation coefficient. The normal range of corrected correlation coefficient ($2r/ r+1$) is between 0.0 and + 1.0 As shown in Table No.(3), all the corrected correlation coefficients values are between 0.0 and +1.0 and the significant (α) is less than 0.05 so all the corrected correlation coefficients are significance at $\alpha = 0.05$. The results were in the range from 0.7785 and 0.8521. This range is considered high; and the reliability coefficient for all paragraphs equal 0.8113, which mean that the results ensures the reliability of the questionnaire.

Table (3) Split Half Technique

Fields	Correlation	Spearman-Brown coefficient	p- value	Significance / Not Significance
Wheelchair User's Shoulder Pain Index	0.7423	0.852092	0.000	**
Shoulder Rating Questionnaire	0.6374	0.778551	0.000	**
All paragraphs	0.6825	0.811293	0.000	**

** Correlation coefficient is significant at the $\alpha = 0.01$

4.10.2 Cronbach's Alpha

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire (Pilot and Hungler, 1999). The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. As shown in Table (4) the Cronbach's t alpha was calculated for the first field of the WUSPI, and the second field of SRQ. The results were in the range from 0.7996 and 0.8761. This range is considered high; and the reliability coefficient for all paragraphs equal 0.8524, which mean that the results ensures the reliability of the questionnaire.

Table(4) Cronbach's Alpha

Field	No. of Items	Cronbach's alpha
Wheelchair User's Shoulder Pain Index	15	0.8761
Shoulder Rating Questionnaire	20	0.7996
All paragraphs	35	0.8524

Thereby, it can be said that the researcher proved that the questionnaire was valid, reliable, and ready for distribution for the population sample.

4.11 Data Entry and Statistical Analysis

The researcher entered the data after a continuous help and support from experts statisticians using Statistical Package for the Social Sciences (SPSS).The data of 80 questionnaires were entered for analysis.

The researcher analyzed the data with help and support of many experts of statisticians and they recommended the usage of :

1. Spearman Correlation Coefficient for measuring the internal consistency

2. spearman brown coefficient used for measuring reliability of the paragraphs of the questioners
3. split half method used for measuring reliability of the paragraphs of the questioners
4. Chi-Square test χ^2 to test if there is a significant agreement in ranking among different perception.

4.12 Limitations of the Study

- Research scales were unavailable in Arabic ,so it needed translation and back translation.
- The population in this study is composed of rehabilitated adult paraplegic, so this sample is not representative of not rehabilitated in inpatient center and for childhood injured.
- Lack of safety due to complex political situation ,especially in remote areas near the borders, closure of Gaza Strip, electricity breakdown, and exacerbation of the paper cost delayed the process of study.
- Incomplete archive system in El Wafa Medical Rehabilitation and Specialized Surgery Hospital before the year of 2000.
- No Statistics resources of disabled persons in Palestinian territories ,especially about SCI persons .
- Some individuals were living in out of reach areas.
- Changes in clients personals data such as ,telephone number and address.
- The researcher was obliged to take the total population as a sample due to low number of the total population which imposes him to make a big effort to reach each one of subjects and convince them for participation in the study, thus collecting data took long time .

Chapter Five

Results

Chapter Five: Results

This chapter describes the results that have been obtained from 80 questionnaires. The information about the sample size, response rate, demographic characteristics data about the subjects are presented.

5.1 Population Characteristics

Eighty manual wheelchair users with paraplegic SCI participated in the study from 93 subjects of the total population eligible for the study with response rate (86%). They ranged in age from 18 to 59 year old, and the majority of the participants (85%) were male and (15%) were female. Fifty percent of the participants received 2-3 months of rehabilitation, (32.5%) received less than 2 months, and (17.5%) received more than 3 months of inpatient rehabilitation.

Fifty one percent of subjects are single and (46%) are married and the remaining subjects are divorced. The general educational level of all the subjects was as follow: (23.8%) primary, (13.8%) preparatory, (46.3%) secondary, (16.3%) high educations.

The monthly income for the most subjects are less than 1000 New Israeli Shaker (NIS) (about 250\$) for 92.5% of them, and the rest earn 250\$ or more.

Sixty two and a half (62.5%) of subjects are living in cities, (30%) in camps, and (7.5%) in rural area.

The causes of injury for the target population were (86.25%) due to traumatic SCI (41.25%) gunshot, (17.5%) falling down, (16.25%) Road Traffic Accident, (8.75%) explosive injury, and (2.5) violence), and (13.75%) nontraumatic SCI {(5%) due to tumor, (5%) congenital, and(3.75%) infections as mylitis}.

All the previous information are summarized in table (5).

Table (5) Population Characteristics (n=80)

Variable	class	Frequency	Percent
Age	Less than 30 years	42	52.5
	30-40 years	23	28.8
	More than 40 years	15	18.8
Gender	Male	68	85.0
	Female	12	15.0
Marital Status	Married	37	46.3
	Single	41	51.3
	Divorce	2	2.5
Period of inpatient rehabilitation	Less than 2 months	26	32.5
	2-3 months	40	50.0
	More than 3 months	14	17.5
Level of education	Primary	19	23.8
	prep	11	13.8
	Secondary	37	46.3
	University	13	16.3
Monthly Income (financial situation)	Less than 1000 NIS	74	92.5
	1000 NIS - 1500 NIS	2	2.5
	1500 NIS - 2000 NIS	2	2.5
	Greater than 2000 NIS	2	2.5
Living area	City	50	62.5
	Camp	24	30.0
	rural	6	7.5
Cause of injury	Traumatic	69	86.25
	Gun Shot(G.S)	33	41.25
	Falling Down(F.D)	14	17.5
	Road Traffic Accident(R.T.A)	13	16.25
	Explosive Injury	7	8.75
	Violence	2	2.5
	Nontraumatic	11	13.75
	Tumor	4	5
	Congenital	4	5
Infections	3	3.75	

5.2 Wheelchair User's Shoulder Pain Index

The researcher found the mean and weight mean for each paragraph of the field of shoulder pain to determine the degrees of the pain, and the results illustrated in table (6) .

Table (6) Weight mean of the shoulder pain for members of sample study

No.	Item	mean	Standard Deviation	Weight mean	Rank
<i>shoulder pain did you experience when</i>					
1	Transferring from a bed to a wheelchair	1.101	1.899	11.0	5
2	Transferring from a wheelchair to a car	1.013	1.784	10.1	7
3	Transferring from a wheelchair to the tub or shower	0.975	1.776	9.7	8
4	Loading your wheelchair into a car	0.333	0.577	3.3	13
5	Pushing your chair for 10 min or more	2.519	2.791	25.2	1
6	Pushing up ramps or inclines outdoors	2.423	2.656	24.2	2
7	Lifting objects down from an overhead shelf	0.763	1.737	7.6	9
8	Putting on pants	0.667	1.551	6.7	10
9	Putting on a T-shirt or pullover	0.595	1.335	5.9	12
10	Putting on a button-down shirt	0.228	0.973	2.3	14
11	Washing your back	0.763	1.513	7.6	9
12	Performing usual daily activities at work or school	1.250	0.957	12.5	3
13	Driving	0.628	1.604	6.3	11
14	Performing household chores	1.194	2.053	11.9	4
15	Sleeping	1.039	2.215	10.4	6
	All paragraphs	1.114	1.433	11.1	

Table (6) illustrated the experiencing of shoulder pain when:

- 1: Pushing your chair for 10 min or more with weight mean (25.2%) and rank first
- 2: Pushing up ramps or inclines outdoors with weight mean (24.2%) and rank second
- 3: Performing usual daily activities at work or school with weight mean (12.5%) and rank third
- 4: Performing household chores with weight mean (11.9%) and rank fourth
- 5: Transferring from a bed to a wheelchair with weight mean (11.0) and rank fifth

- 6: Sleeping with weight mean (10.4) and rank sixth
- 7: Transferring from a wheelchair to a car with weight mean (10.1%) and rank seventh
- 8: Transferring from a wheelchair to the tub or shower with weight mean (9.7%) and rank eighth
- 9: Lifting objects down from an overhead shelf with weight mean (7.6%) and rank ninth
- 10: Washing your back with weight mean (7.6) and rank ninth
- 11: Putting on pants with weight mean (6.7%) and rank tenth
- 12: Driving with weight (6.3%) and rank eleventh
- 13: Putting on a T-shirt or pullover with weight mean (5.9) and rank twelfth
- 14: Loading your wheelchair into a car with weight mean: (3.3) and rank thirteenth
- 15: Putting on a button-down shirt with weight mean (2.3%) and rank fourteenth

In general, the average weight means for all activities equal 11.1

Subjects answered each question by marking an “X” on a 10-cm visual analog scale anchored at “no pain” to “worst pain ever experienced.” If a question did not apply, subjects were asked to mark “NA.”

5.3 Shoulder Rating Questionnaire

The following questions regarding the shoulder for which you have been evaluated or treated. If a question does not apply to you, leave that question blank. If you indicated that both shoulders have been evaluated or treated, please complete a separate questionnaire for each shoulder and mark the corresponding side (right or left) at the top of each form.

1. Considering all the ways that your shoulder affects you, circle a number on the scale below for how well you are doing.

Very poorly { 1 2 3 4 5 6 7 8 9 10 } Very well

Table (7) show that the weight mean of the degrees of shoulder affection equal 59.5%.

Table (7) Degrees of shoulder affection

Degrees of shoulder affects	Frequency	Percent
1	3	14.3
2	1	4.8
3	1	4.8
4	1	4.8
5	3	14.3
6	1	4.8
7	1	4.8
8	6	28.6
9	3	14.3
10	1	4.8
Total	21	100.0
mean = 5.95, weight mean = 59.5%		

5.3.1 Questions Referring to Pain

2. During the past month, how would you describe the usual pain in your shoulder at rest?

Table (8) show that 2.5% of the participants, the usual pain in their shoulder at rest are moderate, 12.5% of the participants, the usual pain in their shoulder at rest are mild, and 85% of the participants, the usual pain in their shoulder at rest are none.

Table (8) the usual pain in shoulder at rest

the usual pain in shoulder at rest	Frequency	Percent
Very severe	0	0
Severe	0	0
Moderate	2	2.5
Mild	10	12.5
None	68	85.0
Total	80	100.0

3. During the past month, how would you describe the usual pain in your shoulder during activities?

Table (9) show that 5% of the participants, the usual pain in their shoulder during activities are severe, 15.0% of the participants, the usual pain in their shoulder during activities are moderate, 41.3% of the participants, the usual pain in their shoulder during activities are mild, and 38.8% of the participants, the usual pain in their shoulder during activities are none.

Table (9) the usual pain in shoulder during activities

how would you describe the usual pain in your shoulder during activities?	Frequency	Percent
Very severe	0	0.0
Severe	4	5.0
Moderate	12	15.0
Mild	33	41.3
None	31	38.8
Total	80	100.0

4-During the past month, how often did the pain in your shoulder make it difficult for you to sleep at night?

Table (10) show that 2.5 % of the participants suffered to sleep at night every day , 8.8% of the participants suffered to sleep at night several days per week, 7.5% of the participants suffered to sleep at night one day per week, and 13.8% of the participants suffered to sleep at night less than one day per week, and 67.5% of the participants did not suffer from sleeping difficulties at night.

Table (10) How often did the pain in your shoulder make it difficult for you to sleep at night?

how often did the pain in your shoulder make it difficult for you to sleep at night?	Frequency	Percent
Every day	2	2.5
Several days per week	7	8.8
one day per week	6	7.5
Less than one day per week	11	13.8
Never	54	67.5
Total	80	100.0

5. During the past month, how often have you had severe pain in your shoulder?

Table (11) show that 6.3 % of the participants complained of severe shoulder pain every day, 5.0% of the participants complained of severe shoulder pain several days per week, 5.0% of the participants complained of severe shoulder pain one day per week, 7.5 % of the participants complained of severe shoulder pain less than one day per week, and 81.3% of the participants have no severe pain in their shoulder.

Table (11) How often have you had severe pain in your shoulder?

how often have you had severe pain in your shoulder?	Frequency	Percent
Every day	0	0.0
Several days per week	5	6.3
one day per week	4	5.0
Less than one day per week	6	7.5
Never	65	81.3
Total	80	100.0

5.3.2 Questions Referring to Daily Activities

Considering all the ways you use your shoulder during daily personal and household activities (e.g., dressing, washing, driving, household chores), how would you describe your ability to use your shoulder?

Table (12) show that 63.8% of the participants described their ability to use their shoulder as no limitation, 22.5% of the participants described their ability to use their shoulder as a mild server limitation, and 16% of the participants described their ability to use their shoulder as very severe, sever and moderate limitation

Table (12) how would you describe your ability to use your shoulder?

how would you describe your ability to use your shoulder?	Frequency	Percent
Very severe limitation; unable	1	1.3
Severe limitation	1	1.3
Moderate limitation	9	11.3
Mild limitation	18	22.5
No limitation	51	63.8
Total	80	100.0

Questions 7–11: During the past month, how much difficulty have you had in each of the following activities due to your shoulder?

7. Putting on or removing a pullover sweater or shirt.

Table (13) show that 7.5% of the participants faced a moderate difficulty when putting on or removing a pullover sweater or shirt, 11.3% of the participants faced mild difficulty when Putting on or removing a pullover sweater or shirt, and 81.3% of the participants faced no difficulty when Putting on or removing a pullover sweater or shirt

Table (13)Putting on or removing a pullover sweater or shirt

Putting on or removing a pullover sweater or shirt	Frequency	Percent
Unable	0	0.0
Severe difficulty	0	0.0
Moderate difficulty	6	7.5
Mild difficulty	9	11.3
No difficulty	65	81.3
Total	80	100.0

8. Combing or brushing hair.

Table (14) show that 1.3 % of the participants faced a moderate difficulty when combing or brushing their hair, 12.5% of the participants faced mild difficulty, and 86.3% of the participants faced no difficulty.

Table (14) Combing or brushing your hair

Putting on or removing a pullover sweater or shirt	Frequency	Percent
Unable	0	0.0
Severe difficulty	0	0.0
Moderate difficulty	1	1.3
Mild difficulty	10	12.5
No difficulty	69	86.3
Total	80	100.0

9. Reaching shelves that are above head

Table (15) show that, 1.3% of the participants faced a sever difficulty when reaching shelves that are above their heads, 2.5 % of the participants faced a moderate difficulty, 16.3% of the participants faced mild difficulty, and 80% from the sample face no difficulty.

Table (15) Reaching shelves that are above head

Reaching shelves that are above your head	Frequency	Percent
Unable	0	0.0
Severe difficulty	1	1.3
Moderate difficulty	2	2.5
Mild difficulty	13	16.3
No difficulty	64	80.0
Total	80	100.0

10. Scratching or washing your lower back with hands

Table (16) show that, 23.8% of the participants faced a mild difficulty when scratching or washing their lower back with hands, and 76.3% of the participants faced no difficulty when scratching or washing their lower back with hands.

Table (16) Scratching or washing your lower back with your hand

Scratching or washing your lower back with your hand	Frequency	Percent
Unable	0	0.0
Severe difficulty	0	0.0
Moderate difficulty	0	0.0
Mild difficulty	19	23.8
No difficulty	61	76.3
Total	80	100.0

11. Lifting or carrying a full bag of groceries (8–10 kg).

Table (17) show 3.8 % of the participants faced a moderate difficulty when lifting or carrying a full bag of groceries (8–10 kg), 12.5% faced a mild difficulty, and 82.5% faced no difficulty.

Table (17) Lifting or carrying a full bag of groceries (8–10 kg)

Lifting or carrying a full bag of groceries (8–10 kg)	Frequency	Percent
Unable	0	0.0
Severe difficulty	1	1.3
Moderate difficulty	3	3.8
Mild difficulty	10	12.5
No difficulty	66	82.5
Total	80	100.0

5.3.3 Questions Referring to Recreational or Athletic Activities

12. Considering all the ways you use your shoulder during recreational or athletic activities (e.g., basketball, volleyball, peg pong ,aerobics, gardening), how would you describe the function of your shoulder?

Table (18) show that 5% of the participants described the function of their shoulder during recreational and athletic activities as severe limitation, 5.0% as moderate limitation, 16.3% as a mild limitation , and 73.8% as no limitation.

Table (18) How would you describe the function of your shoulder during recreational and athletic activities?

how would you describe the function of your shoulder?	Frequency	Percent
Very severe limitation; unable	0	0.0
Severe limitation	4	5.0
Moderate limitation	4	5.0
Mild limitation	13	16.3
No limitation	59	73.8
Total	80	100.0

13. During the past month, how much difficulty have you had throwing a ball overhand or serving in tennis due to your shoulder?

Table (19) show that 3.8% of the participants had severe limitation when they had throwing a ball overhand or serving in tennis, 2.5% had a moderate limitation, 12.5% had a mild limitation, and 81.3% had no limitation

Table (19) How much difficulty have you had throwing a ball overhand or serving in tennis due to your shoulder?

how much difficulty have you had throwing a ball overhand or serving in tennis due to your shoulder?	Frequency	Percent
Very severe limitation; unable	0	0.0
Severe limitation	3	3.8
Moderate limitation	2	2.5
Mild limitation	10	12.5
No limitation	65	81.3
Total	80	100.0

14. The degree of limitation at shoulder due to activities .

Table (20) show that 75% of the participants had no limitation at shoulder due to activities, 20.0% had a mild limitation, 3.8% had moderate limitation, and 1.3% had very severe limitation.

Table (20) The degree of limitation at shoulder due to activities

The degree of limitation at shoulder due to activities	Frequency	Percent
Very severe limitation; unable	1	1.3
Severe limitation	0	0.0
Moderate limitation	3	3.8
Mild limitation	16	20.0
No limitation	60	75.0
Total	80	100.0

5.3.4 Questions Referring to Work

15. During the past month, what has been your main form of work?

Table (21) show that the main form of work for 11.3% of the participants are paid work, 2.5% are housework, 12.5% are schoolwork, 67.5% are unemployed, 3.8% are disabled due to their shoulder, and 2.5% are retired.

Table (21) During the past month, what has been your main form of work?

During the past month, what has been your main form of work?	Frequency	Percent
Paid work	9	11.3
Housework	2	2.5
Schoolwork	10	12.5
Unemployed	54	67.5
Disabled due to your shoulder	3	3.8
Disabled secondary to other causes	0	0.0
Retired	2	2.5
Total	80	100.0

If you answered D, E, F, or G to the above question, please skip questions 16–19 and go on to question 20.

16. During the past month, how often were you unable to do any of your usual work because of your shoulder?

Table(22) show that 9.5% from the sample unable to do any of their usual work because of their shoulder all days, 4.8% from the sample unable to do any of their usual work because of their shoulder several day per week, 4.8% from the sample unable to do any of their usual work because of their shoulder less than one day per week, 81.0% from the sample able to do any of their usual work all the time.

Table (22) How often were you unable to do any of your usual work because of your shoulder?

How often were you unable to do any of your usual work because of your shoulder?	Frequency	Percent
All days	2	9.5
Several days per week	1	4.8
one day per week	0	0.0
Less than one day per week	1	4.8
Never	17	81.0
Total	21	100.0

17. During the past month, on the days that you did work, how often were you unable to do your work as carefully or as efficiently as you would like because of your shoulder?

Table (23) show that 4.8% of the participants were unable to do their work as carefully or as efficiently as they would like because of their shoulder several day per week, 9.5% one day per week, 4.8% less than one day per week, and 81% of the participants abled to do there's work as carefully or as efficiently as they would like because of their shoulder all the time.

Table (23) How often were you unable to do your work as carefully or as efficiently as you would like because of your shoulder?

How often were you unable to do your work as carefully or as efficiently as you would like because of your shoulder?	Frequency	Percent
All days	0	0.0
Several days per week	1	4.8
one day per week	2	9.5
Less than one day per week	1	4.8
Never	17	81.0
Total	21	100.0

18. During the past month, on the days that you did work, how often did you have to work a shorter day because of your shoulder?

Table (24) show that 4.8% of the participants worked a shorter day because of shoulder pain several day per week, 4.8% one day per week, 90.5% of the participants did not short their work day because of shoulder pain all the time.

Table (24) How often did you have to work a shorter day because of your shoulder?

How often did you have to work a shorter day because of your shoulder?	Frequency	Percent
All days	0	0.0
Several days per week	1	4.8
one day per week	1	4.8
Less than one day per week	0	0.0
Never	19	90.5
Total	21	100.0

19. During the past month, on the days that you did work, how often did you have to change the way that your usual work is done because of your shoulder?

Table (25) show that 9.5% of the participants changed the way of usual work because of the shoulder several days per week, 9.5% of the participants changed the way of usual work because of the shoulder one day per week, 4.8% of the participants changed the way of usual work because of the shoulder less than one day per week, and 76.2% of the participants never change the way of usual work because of the shoulder.

Table (25) how often did you have to change the way that your usual work is done because of your shoulder

how often did you have to change the way that your usual work is done because of your shoulder	Frequency	Percent
All days	0	0.0
Several days per week	2	9.5
one day per week	2	9.5
Less than one day per week	1	4.8
Never	16	76.2
Total	21	100.0

5.3.5 Questions Referring to Satisfaction and Areas for Improvement

20. During the past month, how would you rate your overall degree of satisfaction with your shoulder?

Table (26) show that the overall degree of satisfaction with their shoulder for 13.8% of the participants was fair, 25% as good satisfaction, 35% as very good satisfaction, and the overall degree of satisfaction with their shoulder for 26.3% of the participants was excellent.

Table (26) how would you rate your overall degree of satisfaction with your shoulder?

how would you rate your overall degree of satisfaction with your shoulder?	Frequency	Percent
Poor	0	0.0
Fair	11	13.8
Good	20	25.0
Very good	28	35.0
Excellent	21	26.3
Total	80	100.0

21. Please rank the 2 areas in which you would most like to see improvement (place a 1 for the most important, a 2 for the second most important).

Table (27) show that the participants most like to see improvement of the daily personal and household activities, and work which ranked as the first for 50 subjects. 30 subjects like to see improvement of the pain of shoulder and recreational activities as the first priority. 50 subjects chose recreational or athletic activities and daily personal activities as the second areas which they most like to see improvement, 18 subjects for work, and 12 for pain of shoulder.

Table (27) Areas to be improved

Areas to be improved	Area 1 (freq.)	1 ST Priority Ranking	Area2 (freq.)	2 nd Priority Ranking
Pain of shoulder	15	2	12	3
Daily personal and household activities	25	1	25	1
Recreational or athletic activities	15	2	25	1
Work	25	1	18	2

5.4 Population Characteristics and Shoulder Pain

5.4.1 Population Characteristic and Shoulder Pain at Rest and During Activities

There is a relation between the usual pain shoulder at the rest and during activities , and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income, Living area) at significant level $\alpha = 0.05$.

To test the hypothesis the researcher used the chi-square test, and the results are shown in table (28) which illustrated that, there is no relation between the usual shoulder pain at rest and age, gender, marital status, period of inpatients rehabilitation, and level of education since the p- value was greater than 0.05, but there is a relation between the usual shoulder pain at rest and income since the p-value was (0.003) less than 0.05.

There is no relation between the usual pain during activities, age, gender, marital status, period of inpatients rehabilitation, and income since the p-value was greater than 0.05, but there is a relation between the usual pain during activities and level of education since the p-value was (0.019) less than 0.05.

Table (28) Cross Tabulation between socio-demographic characteristic and shoulder pain at rest and activities

Variable	The shoulder pain at rest		The shoulder pain during activities	
	Chi-square	p-value	Chi-square	p-value
Age	4.478	0.345	2.908	0.820
Gender	0.623	0.732	1.755	0.625
Marital Status	2.766	0.598	7.563	0.272
Period of inpatient rehabilitation	3.217	0.522	2.906	0.814
Level of education	5.472	0.485	19.9	0.019
Income (financial situation)	19.746	0.003	13.105	0.158
Living area	1.319	0.858	5.142	0.526

5.4.2 Population Characteristic and Pain which Make Sleep Difficulty at Night

There is a relation between the shoulder pain which make sleep difficulty at night, and (Age, Gender, Marital Status, Period of inpatient rehabilitation, $\alpha = 0.05$ Level of education, Income , Living area) at significant level

To test the hypothesis the researcher used the chi-square test and the results are shown in table (29) which illustrated that, there is no relation between the shoulder pain which make sleep difficulty at night, and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income , Living area) at significant level $\alpha = 0.05$ since the p-value was greater than 0.05

Table (29) The relationship between the shoulder pain which make sleep difficulty at night, and population characteristics

Variable	between the shoulder pain which make sleep difficulty at night	
	Chi-square	p-value
Age	10.861	0.210
Gender	3.589	0.465
Marital Status	11.237	0.189
Period of inpatient rehabilitation	5.415	0.712
Level of education	16.182	0.183
Income (financial situation)	8.860	0.715
Living area	7.139	0.522

5.4.3 Population Characteristic and Severity of Shoulder Pain

There is a relation between severity of shoulder pain and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income, $\alpha = 0.05$ Living area) at significant level

To test the above hypothesis the researcher used the chi-square test and the results are shown in table (30) which illustrated that, there is no relation between severity of shoulder pain and (Age, marital status, period of inpatient rehabilitation, living area) since the p-value was greater than 0.05, but there is a relation between severity of shoulder pain and (gender, level of education) at significant

level $\alpha = 0.05$ since the the value of p-value equal 0.021, and 0.040 which is less than 0.05.

Table (30) Cross tabulation between population characteristics and severity of shoulder pain

Variable	Severity of shoulder pain	
	Chi-square	p-value
Age	6.638	0.356
Gender	9.774	0.021
Marital Status	6.291	0.391
Period of inpatient rehabilitation	3.796	0.704
Level of education	17.638	0.040
Income (financial situation)	9.738	0.342
Living area	7.486	0.278

5.4.4 Population Characteristic and the Ability of shoulder Using

There is a relation between the ability of shoulder using, and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income, $\alpha = 0.05$ Living area) at significant level

To test the hypothesis the researcher used the chi-square test and the results are shown in table (31) which illustrated that, there is no relation between ability of shoulder using and (age, gender, marital status, period of inpatient rehabilitation, level of education, income) since the p-value was greater than 0.05, but there is a statistical relation between living area and the ability of shoulder using since the p-value equal 0.043.

Table (31) The relationship between population characteristic and the ability of shoulder using

Variable	Ability of shoulder Using	
	Chi-square	p-value
Age	11.341	0.183
Gender	0.825	0.935
Marital Status	5.260	0.730
Period of inpatient rehabilitation	9.658	0.290
Level of education	11.864	0.457
Income (financial situation)	6.974	0.589
Living area	15.955	0.043

5.4.5 Population Characteristic and Recreational and Athletic Activities

There is a relation between the function of the shoulder during recreational and athletic activities and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income, Living area) at significant level $\alpha = 0.05$

To test the hypothesis the researcher used the chi-square test and the results are shown in table (32) which illustrated that, there is no relation between the function of shoulder during recreational and athletic activities and (age, gender, marital Status, period of inpatient rehabilitation, level of education, income, living area) since p-value was greater than 0.05.

Table (32) The relationship between the function of shoulder during recreational and athletic activities and population characteristics

Variable	The function of shoulder during recreational and athletic activities a	
	Chi-square	p-value
Age	10.679	0.098
Gender	1.589	0.662
Marital Status	1.247	0.975
Period of inpatient rehabilitation	0.6131	0.409
Level of education	10.163	0.337
Income (financial situation)	10.344	0.323
Living area	6.627	0.357

There is a relation between the difficulty of throwing a ball overhand or serving in tennis due to the shoulder and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income , Living area) at $\alpha = 0.05$ significant level

To test the hypothesis the researcher used the chi-square test and the results are shown in table (33) which illustrated that, there is no relation between the difficulty of throwing a ball overhand or serving in tennis due to the shoulder, and (age, gender, marital Status, period of inpatient rehabilitation, level of education, income, living area) since p-value was greater than 0.05.

Table (33) The relationship between the difficulty of throwing a ball overhand or serving in tennis due to the shoulder and population characteristics

Variable	difficulty of throwing a ball overhand or serving in tennis due to the shoulder	
	Chi-square	p-value
Age	5.312	0.505
Gender	1.267	0.737
Marital Status	1.163	0.979
Period of inpatient rehabilitation	4.540	0.604
Level of education	16.628	0.055
Income (financial situation)	1.497	0.997
Living area	8.933	0.177

5.4.6 Population Characteristics and Work

There is a relation between the main form of work and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income, Living area) at significant level $\alpha = 0.05$

To test the hypothesis the researcher used the chi-square test and the results are shown in table (34) which illustrated that, there is a relation between the main form of work (and age, gender, marital Status, level of education, living area) since p-value was less than 0.05, but there is no relation between the main form of work, and (period of inpatient rehabilitation, income) since p-value was greater than 0.05.

Table (34) The relationship between the main form of work and population characteristics

Variable	The main form of work	
	Chi-square	p-value
Age	20.735	0.023
Gender	12.956	0.024
Marital Status	22.670	0.012
Period of inpatient rehabilitation	14.485	0.152
Level of education	54.252	0.000
Income (financial situation)	22.486	0.096
Living area	38.726	0.000

There is a relation between inability do usual work because the shoulder and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income, Living area) at significant level $\alpha = 0.05$

To test the hypothesis the researcher used the chi-square test and the results are shown in table (35) which illustrated that, there is no relation between inability to do usual work because the shoulder and (age, gender, marital status, period of inpatient rehabilitation, level of education, living area) since p-value was greater than 0.05, but there is a relation between inability to do usual work because the shoulder and income since p-value was less than 0.05.

Table (35) The relationship between inability to do usual work because the shoulder population characteristics

Variable	Inability to do usual work because the shoulder	
	Chi-square	p-value
Age	5.676	0.640
Gender	4.138	0.247
Marital Status	5.437	0.143
Period of inpatient rehabilitation	8.172	0.226
Level of education	13.245	0.152
Income (financial situation)	21.654	0.010
Living area	5.194	0.514

There is a relation between inability to do work as carefully or as efficiently because the shoulder and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income, Living area) at significant level $\alpha = 0.05$

To test the hypothesis the researcher used the chi-square test and the results are shown in table (36) which illustrated that, there is no relation between inability to do work as carefully or as efficiently because the shoulder and (age, gender, marital status, period of inpatient rehabilitation, level of education, income) since p-value was greater than 0.05, but there is a relation between inability to do work as carefully or as efficiently because the shoulder and living area, since the p value was less than 0.05.

Table (36) The relationship between inability to do work as carefully or as efficiently because the shoulder and shoulder population characteristics

Variable	Inability to do work as carefully or as efficiently because the shoulder	
	Chi-square	p-value
Age	5.676	0.460
Gender	4.138	0.247
Marital Status	5.435	0.143
Period of inpatient rehabilitation	8.172	0.226
Level of education	13.245	0.152
Income (financial situation)	1.163	0.999
Living area	14.066	0.029

There is a relation between working a shorter day because of the shoulder and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of $\alpha = 0.05$ education, Income, Living area) at significant level

To test the hypothesis the researcher used the chi-square test and the results are shown in table (37) which illustrated that, there is no relation between working a shorter day because of the shoulder and (age, gender, marital status, period of inpatient rehabilitation, level of education, income) since p-value was greater than 0.05, but there is relation between working a shorter day because of the shoulder and living area, since p- value less than 0.05.

Table (37) The relationship between working a shorter day because of the shoulder and population characteristics

Variable	Working a shorter day because of the shoulder	
	Chi-square	p-value
Age	4.421	0.352
Gender	3.592	0.166
Marital Status	2.432	0.296
Period of inpatient rehabilitation	6.858	0.144
Level of education	10.684	0.099
Income (financial situation)	0.520	0.998
Living area	10.852	0.028

There is a relation between changing the way of usual work because the shoulder and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income (financial situation), Living area) at significant level

$$\alpha = 0.05$$

To test the hypothesis the researcher used the chi-square test and the results are shown in table (38) illustrated that, there is no relation between changing the way of usual work because the shoulder and (age, gender, marital status, period of inpatient rehabilitation, level of education, income) since p-value was greater than 0.05, but there is relation between changing the way of usual work because the shoulder and living area, since p- value less than 0.05.

Table (38)The relationship between changing the way of usual work because the shoulder and population characteristics

Variable	changing the way of usual work because the shoulder	
	Chi-square	p-value
Age	8.063	0.234
Gender	1.706	0.636
Marital Status	3.961	0.266
Period of inpatient rehabilitation	4.644	0.590
Level of education	10.565	0.307
Income (financial situation)	1.544	0.997
Living area	14.795	0.022

5.4.7 Population Characteristics and Satisfaction

There is a relation between overall degree of satisfaction with the shoulder and (Age, Gender, Marital Status, Period of inpatient rehabilitation, Level of education, Income (financial situation), Living area) at significant level
 $\alpha = 0.05$.

To test the hypothesis the researcher used the chi-square test and the results in table (39) which illustrated that, there is no relation between overall degree of satisfaction with the shoulder and (age, gender, period of inpatient rehabilitation, level of education, income) since p-value was greater than 0.05, but there is relation

between overall degree of satisfaction with the shoulder, and marital status since p-value was less than 0.05.

Table (39) The relationship between overall degree of satisfaction with the shoulder and population characteristics

Variable	Overall degree of satisfaction with the shoulder	
	Chi-square	p-value
Age	8.190	0.224
Gender	1.711	0.634
Marital Status	12.693	0.048
Period of inpatient rehabilitation	0.934	0.988
Level of education	10.541	0.309
Income (financial situation)	9.184	0.420
Living area	4.408	0.622

Chapter six

Discussion, Conclusion, and Recommendations

Chapter Six: Discussion, Conclusion, and Recommendations

6.1 Overview

As outlined in Chapter Two spinal cord injury is a devastating, sudden onset injury which may result in permanent paralysis and loss of physical function. The injured individual is usually dependent on a wheelchair for mobility and may require varying levels of personal care assistance with activities of daily living. Medical treatment and rehabilitation following spinal cord injury typically requires a lengthy period of hospitalization and rehabilitation.

As discussed in Chapter Three, the literature confirms that, shoulder pain among SCI survivors who use manual wheelchair has a high prevalence rate and its effect on daily activities ,work, and participation of recreational activities.

Since pain is a subjective score ,and not a physical outcome measurement ,it is difficult variable to work with.

In this survey study, the researcher used different scales to ask whether subjects experienced pain in some daily activities, work, and participation of recreational activities , and to determine the score or degree of pain.

6.2 Population characteristics

The respondents for the study are representative of paraplegics populations rehabilitated in El Wafa Medical Rehabilitation Center.

Males (85%) ,and largely young (52.5% under 30 years of age). This results resemble all the studies which reported a high ratio toward male and young population(Alaranta et al., 2000; Jackson et al., 2004; NSCID, 2005.)

It has been proved before that majority of own sample was young and males, as Cure Paralysis Now(2002) reported that SCI chiefly affects young people between the ages of 16 and 30. They account for 55% of all SCI, with 80-82% of cases occurring in males.

Fifty one percent of the subjects were single at the time of collecting data, and about (46%) were married(1.3% got marriage after injury), resembling what (NSCID, 2005) reported that, most people with SCI have never been married at time of injury (51.8%), with the reduced likelihood of getting married after injury).

Fifty percent (50%) of respondents stayed 2-3 months as inpatient rehabilitation period, and (32.5 %)less than 2 months .

The educational background of the respondents was relatively moderate with almost 46.3% having 12 years(secondary) with a rate lower than those of the general population,.

Most of the subjects (92.5%) of the respondents having an income of less than 1000NIS(250\$) per month, and were fully dependent on government funded support programs. It was also found that(62.5%)of the sample lived in cities and 30% in camps.

This low income was due to a high rate of unemployment (67.5%), and a low percentage of high education (16.3%).

6.3 Causes of Injury

In our study ,the percentage of traumatic as a cause of injury to a nontraumatic was high (86% to 14%), and gunshot was the major cause of injury accounting for about (41%) of the injuries, followed with (17.5%) falling down, and about (16%) road traffic accident from the total sample. This findings disagree with most of epidemiological studies which consider road traffic accident as the first cause of traumatic SCI, and falling as the next cause (NSCID, 2005; Lin, 2003; Somers, 2001). This may be attributed to the special situation here in Gaza strip from the continuous Israeli attacks, which left thousands of people with poly traumas.

6.4 Shoulder Pain Related to Activities of Daily Living

The researcher used the valid and reliable wheelchair user shoulder pain index (WUSPI), to know what are the activities which cause and exacerbate shoulder pain among wheelchairs users, and found that pushing the wheelchair for 10 min or more is considered as the most cause of shoulder pain, followed by pushing up ramps or inclines outdoors, performing usual daily activities at work or school, performing household chores, transferring from a bed to a wheelchair, sleeping, transferring from a wheelchair to a car, transferring from a wheelchair to the tub or shower, lifting objects down from an overhead shelf, washing the back, Putting on pants, driving, putting on a T-shirt or pullover, loading the wheelchair into a car ,and finally when putting on a button-down shirt, respectively.

These findings were supported by Subbarao et al., (1995) who designed a study to determine which activities caused or exacerbated the shoulder pain, and assessed functional and emotional responses to chronic pain and found out that wheelchair propulsion and transfers caused the most pain and also increased the degree of pain.

Girona and his colleagues (2004) reported that shoulder pain intensity was most severe during the performance of wheelchair-related mobility and transportation activities . In the same line, Gellman et al., (1988) found that Twenty-five of paraplegic complained of shoulder pain during transfer activities .

But in contrast, Curtis and Black (1999) determined the highest intensity of shoulder pain was reported during household chores and activities, propulsion on ramps or inclines, lifting overhead, and while sleeping , these activities ranked in our current study at 4th, 2th ,9th, 6th respectively, and in the same way Salisbury et al., (2006) found that the most painful activity was lifting an object from overhead which ranked ninth in our study .

Although shoulder pain may not initially limit an individual's ability to perform functional activities, if mobility is lost because of disabling shoulder pain, the physical, social, and vocational consequences for wheelchair users are significant (Curtis and Black, 1999).

6.5 Prevalence of Shoulder Pain

Sixty two percent of subjects reported shoulder pain during their usual activities ranged from mild (41%) to severe (5%) but it was relieved by rest to reach (15%) of the subjects ranged from mild to moderate shoulder pain. Moreover there is a relation between shoulder pain during activities and level of education (p-value=0.019).

This high prevalence rate was similar of many studies all over the world which ranged from (30% to 70%), For example: Nicholas et al., (1979), have found that the shoulder pain affect over one half (51.4%) of SCI respondents ,Curtis et al.,(1999b) have found (42%) of the subjects with paraplegia reporting current pain. Also, Curtis and Black (1999) found that (72%) of the subjects reported shoulder pain since wheelchair use, with 52% reporting current shoulder pain.

Eighty percent of subjects did not complain of any shoulder pain at rest times, that mean the alleviation of shoulder pain firstly done by the rest and it may lead to minimizing social participation for the manual wheelchairs users. There is a relation between shoulder pain at rest and financial situation(p=0.003)

When shoulder pain occurs in a person with SCI, mobility and daily activities are even further limited by this “secondary” disability. Unlike the nondisabled person

who experiences shoulder pain, persons with SCI are not able to rest their shoulders when pain develops, as the upper limbs are required for all activities of daily living.

In general, (64%) have reported no limitation to use their shoulder during daily personal and household activities (e.g., dressing, washing, driving, household chores), one subject has very severe limitation and another one has severe limitation, with a same percentage (1.3%). Nine subjects (11.3%), and 18 subjects (22.5%) complained of moderate and mild limitation to use their shoulder alternatively.

The researcher asked the subjects about specific daily activities which need fine motor activities and the difficulties which encountered by the subjects as the following:

Eighty one have no difficulty of putting on or removing a pullover sweater or shirt. and about 19% reported mild to moderate difficulty of due to shoulder pain.

Eighty six of subjects had no difficulty of Combing or brushing hair, 10 subject (12.5%) had mild difficulty, and one subject (1.3%) had moderate difficulty to comb or brush their hair due to shoulder pain. (80 %) of subjects had no difficulty to reach shelves that are above their heads, and (20%) had difficulty ranged from mild to severe difficulty, contrast to what reported by Salisbury et al, (2006) who found that found that the most painful activity was lifting an object from overhead.

Seventy six had no difficulty in scratching or washing their lower back with their hand, (23%) of them had mild difficulty.

No difficulty of lifting or carrying a full bag of groceries (8–10 kg) for (82.5%) of the respondents was reported, (12.5%) had mild difficulty, (3.8%) had moderate difficulty, one subject (1.3%) had severe difficult to lift or carry a full bag of groceries. As the researcher noted that the previous activities had low difficulties to do it.

Sixty seven percent of the participants were able to sleep well without troubles due to their shoulder pain or because they do not have shoulder pain, but the remaining respondents have suffered from sleeping problems due to shoulder pain with different

degree, (13.8%) reported less one day per week difficulty to sleep because of shoulder pain, (7.5%) reported one day per week of sleeping difficulty, (8.8%) several days of sleeping difficulty, and (2.5%) every day sleeping troubles due to shoulder pain

In the last month, about 81% never complained of severe shoulder pain in any day through the month, and (19%) register severe pain as follow: (6.3%) of the total respondents registered severe pain every day per week in their shoulder, (5%) several days per week, (5%) one day per week, and (7.5 %) less than one day per week.

6.6 Recreational and athletic activities

About (74%) of the total number of 80 subjects described the function of their shoulder during the recreational or athletic activities as having no limitation to use their shoulders, (16%) had mild limitation, and (10%) had moderate to severe limitation to use their shoulders in recreational and sport activities.

Throwing a ball as a part of sporting a activity, showed a high percentage of absence of any limitation to throw it (81.3%) ,while (12.5%)(2.5%)(3.8%)of subjects had mild, moderate, and severe limitation to throw the ball respectively.

Majority denied any limitation during recreational and athletic activities for (75%) of subjects, and (25%) of them had variables degrees of limitation during activities, regarding the actual situation in Gaza Strip ,no actual opportunities for continuous and fixed recreational and athletic activities and also due to shortage of recreational and sport places safely for disabled persons.

The researcher did not find studies concerning recreational and athletic activities for SCI persons.

In fact, this specific area is affected by realities on ground in Gaza strip, there are no places designated for disabled sporting and recreational activities.

6.7 Work and Employment

Sixty seven percent of all subjects are unemployed, and (26.3%) of subjects has a work and distributes as following: (11.3%) have paid work, (2.5%) housework, and (12.5%) are school workers.

Four percent (3.8%) are unable to perform any job due to the pain in their shoulder, and (2.5%) were retired early after the injury. Moreover, there is a relation between main form of work, and age, gender, marital status, level of education, living area ($p= 0.023, 0.024, 0.012, 0.00, 0.00$ respectively), and this agree with some studies.

Twenty six of our subjects still do have a job and earning a living which is lower than what are in many studies as following: In more recent studies the percentages of persons gainfully working improved and ranged from 31 to 48% (Siösteen et al.,1990; Murphy et al.,1997). In the US less than 30% of the 18- to 62-year-old persons with traumatic SCI were employed (Hunt et al., 1999).

Levi et al., (1996) reported that (46%) of their study population, consisting of persons with SCI living in Greater Stockholm area in Sweden, were gainfully employed .These figures are clearly lower than the overall employment rate of 73% in the general Swedish population aged 15 to 64 in 2003 (Eurostat, 2004).

Dorsett (2001) found that, employment of the respondents dropped from (83%) who were employed pre-injury to only (14%) employed immediately following discharge from hospital. Almost half the respondents (46%) were fully dependent on government funded income support , with 70% of the respondents having an income of less than \$400 per fortnight at the time of discharge from hospital. At three years post discharge from hospital almost 40% of the sample continued to report income of less than \$400 per fortnight .

Dalyan and his colleagues (1999) found a significant association between employment status and upper limb pain – unemployment is higher (21.4% versus 7.1%) and full-time employment is lower (20% versus 45.2%) in persons with upper limb pain when compared to those without such pain.

Individuals who have higher levels of education are consistently identified as having a better chance of being employed. This outcome may also be influenced by the fact that higher levels of education may prepare people for occupations that are less physically demanding.

It has also been suggested that engaging in educational activities post-injury are a significant predictor of employment (Tomassen et al., 2000), this may explain that low educational level in our current research (university education was about (16%) as one of the main factors which confronts most the most paraplegics under study.

Although in our study most target population under study are young and have less severe injury, but a lower rate of employment was found, and it contradict to what DeVivo and Richards (1992) reported that people with less severe injuries (i.e. incomplete injuries or paraplegia) have a greater chance of re-entering the workforce, and those who are younger at the time of injury have a greater chance of becoming employed post injury .

It is thought in our population, the low level of education among SCI clients will further decrease the chances of finding a job.

Many of the factors identified as predictors of employment for spinal cord injured persons are biographical characteristics such as age, gender, or race and as such are not amenable to intervention by rehabilitation professionals. Education and transport issues are the easily addressed issues that will directly impact on the individual. Other issues require intervention at a policy or societal level (Dorsett, 2001).

Due to a low number of employed subjects (21 out of 80), the following data concerning these group of employees:

From the 21 subjects 17 (81%) were able to do their usual work carefully or efficiently as they would, 2 subjects (9.5%) were unable to do any of their usual work all days ,(4.8%) were enabled to do any of their usual work several days per a week, and the same percentage unable to work their usual work but less than one day per a week.

Five percent from of the participants worked a shorter day because of shoulder pain several days per week, 4.8% worked a shorter day because of shoulder pain one day per week, but amazingly that, (90.5%) of those who are employed did not cut short their working days for any time during the week.

From the previous findings, the researcher concluded that just 17 subject (about 21% from the total sample) have a work without any troubles leading them to cut short their work day and thus work efficiently.

Nine and a half percent of the participants change the way of usual work because of the shoulder several day per week, (9.5%) of the participants change the way of usual work because of the shoulder one day per week, (4.8%) of the participants change the way of usual work because of the shoulder less than one day per week, (76.2%) of the participants never change the way of usual work because of the shoulder.

No relevant studies regarding workplace of persons with traumatic or nontraumatic SCI were found.

6.8 Degree of satisfaction about shoulder function

Degree of satisfaction distribute between fair to excellent satisfaction, (35%) rate their overall degree of satisfaction as very good, (25%) good, (26.3%) excellent, (13.8 %) fair. There is a relation between overall degree of satisfaction with the shoulder, and marital status($p= 0.048$).

Twenty five of subjects (31%) chose daily personal and household activities and same percentage chose work as a first priority to be improved, followed with 15 subjects (19%) wish to have improvement in shoulder pain, and (19%) of subjects wish to have less limitation in recreational and athletic activities. (25) of subjects(31%) chose daily personal and household a activities, and also the same number of subjects

(31%) recreational and athletic activities as number two priority that they wished to be improved, followed with work (22.5%), and shoulder pain(15%).

These finding revealed that the subjects first priority for improvement was daily personal and household activities, and work followed with recreational and athletics a activities.

6.9 Conclusions

- The study revealed that the SCI persons were mainly male (85%), and approximately half of the respondents were young (52.5% under 30 years of age), and single (51%).

- About two third of subjects were unemployed.

- Shoulder pain was prevalent (62%) among SCI paraplegics who are using MWC especially during their usual activities which ranged from mild to severe ,but it relieve at rest to reach (15%) of the subjects ranged from mild to moderate shoulder pain .

- There is a relationship between shoulder pain among adult paraplegic manual wheelchair users and activities related to wheelchair propulsion, and the most activities that cause and exacerbate shoulder pain were pushing the wheelchair for 10 min or more, followed by pushing up ramps or inclines outdoors, performing usual daily activities at work or school , performing household chores, and transferring from a bed to a wheelchair .

- Sixty four have reported no limitation to use their shoulder during daily personal and household activities and about (74%) of the total number of 80 subjects described the function of their shoulder during the recreational or athletic activities as having no limitation to use their shoulder.

- Thirty five of the respondents rate their overall degree of satisfaction with the shoulder functioning as very good, (25%) rated it as good, (26.3 %) as excellent, and (13.8%) fair.
- Daily personal and household activities, and work ranked as a first priority for hoped improvement among the subjects, followed by recreational and athletic activities, and shoulder pain as a second class for improvement.
- There is a relation between the level of education and shoulder pain during activities, and no relation between (age, gender, marital status, period of inpatient rehabilitation, income, and living area).
- There is a relation between the income and shoulder pain at rest, and no relation between (age, gender, marital status, period of inpatient rehabilitation, level of education, and living area).

6.10 Recommendations

- Further researches about the prevalence of shoulder pain among outpatient rehabilitated spinal cord persons and among pediatric SCI which not included in this research are needed.
- Implement an environmental adaptations for streets, and crossings as well as the entrances in all institutions to be more suitable for disabled.
- Conducting a study on the quality of life among those with shoulder pain.
- A study to answer the following questions are a) what are the treatment options to relieve pain, and b) are psychological factors has any effect on shoulder pain and treatment.
- The researcher recommends that MOH and decision makers should put enough budgets for tertiary rehabilitation.
- Further experimental researches about the types of shoulder pain and specific causes concerning the shoulder pain.
- Advocating for the rights of those of SCI for specialized places for sporting and recreational activities .
- Implement the (5%) quota for employment of disabled.

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Annex (1)

التاريخ :

عزيزي المشترك :

السلام عليكم ورحمته وبركاته

سوف أقوم بعمل دراسة مسحية حول آلام الكتف على الأشخاص الذين يعانون من شلل في الأطراف السفلية وتأهلوا سابقا في مركز طبي للتأهيل و يستخدمون الكراسي المتحركة.

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ادعوك بكامل الاحترام والحرية للمشاركة في هذه الدراسة والتي مدتها ستة شهور ، بإمكانك عدم الإجابة على أي سؤال إن أردت ذلك وعدم إجابتك لن تؤثر على هويتك بأي حال من الأحوال .

جميع المعلومات التي سوف تؤخذ منك ستعتبر سرية.

يمكنك الاستفسار عن أي معلومات إضافية إذا أحببت

بالاتصال على جوال رقم (0599883113)

الباحث : جاد الله مصطفى الشافعي

Annex (2)

مسلسل _____

إستبانة

المعلومات الأولية الشخصية :

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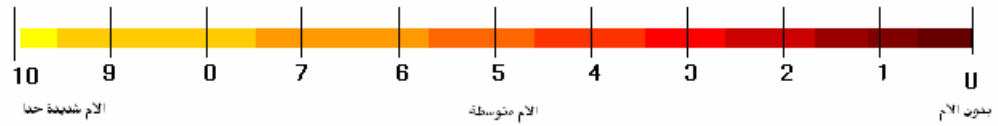
ب) استبيان مؤشر آلام الكتف لمستخدمي الكرسي المتحرك:

خلال الأسبوع الماضي، كم كانت حدة الألم عند أداء الأنشطة التالية :
للإجابة عن كل سؤال بوضع علامات "X" على 10 سم المرعيه التناظرية الراسية في الجدول
"لا يوجد ألم" إلى "أسوأ ألم على الإطلاق". إذا كان السؤال لا ينطبق فعلى المشاركين كتابة "غير
متوفر"

-1



2. الانتقال من الكرسي المتحرك إلى السيارة؟



3. الانتقال من الكرسي المتحرك إلى حوض(البانيو) أو الدش؟



4. تحميل كرسيك المتحرك داخل السيارة ؟



5. دفع كرسيك لمدة 10 دقيقة أو أكثر؟



6. الدفع في رصيف المخصص للمعاقين (الرام)؟



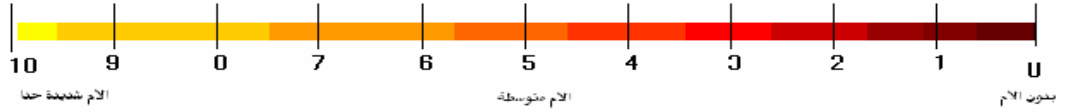
7. رفع أشياء من فوق الرف؟



8. ارتداء البنطلون؟



9. ارتداء القميص أو البلوزة؟



10. وضع أزرار القميص؟



11. تنظيف ظهرك؟



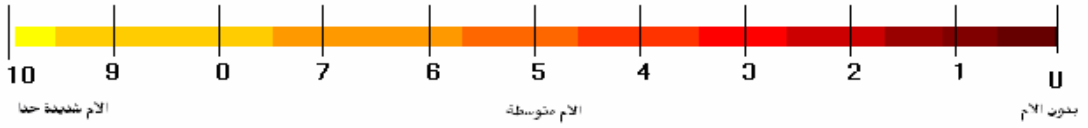
12. أداء الأنشطة اليومية المعتادة في العمل أو المدرسة؟



13. قيادة السيارة؟



14. أداء الأعمال المنزلية؟



15. النوم؟



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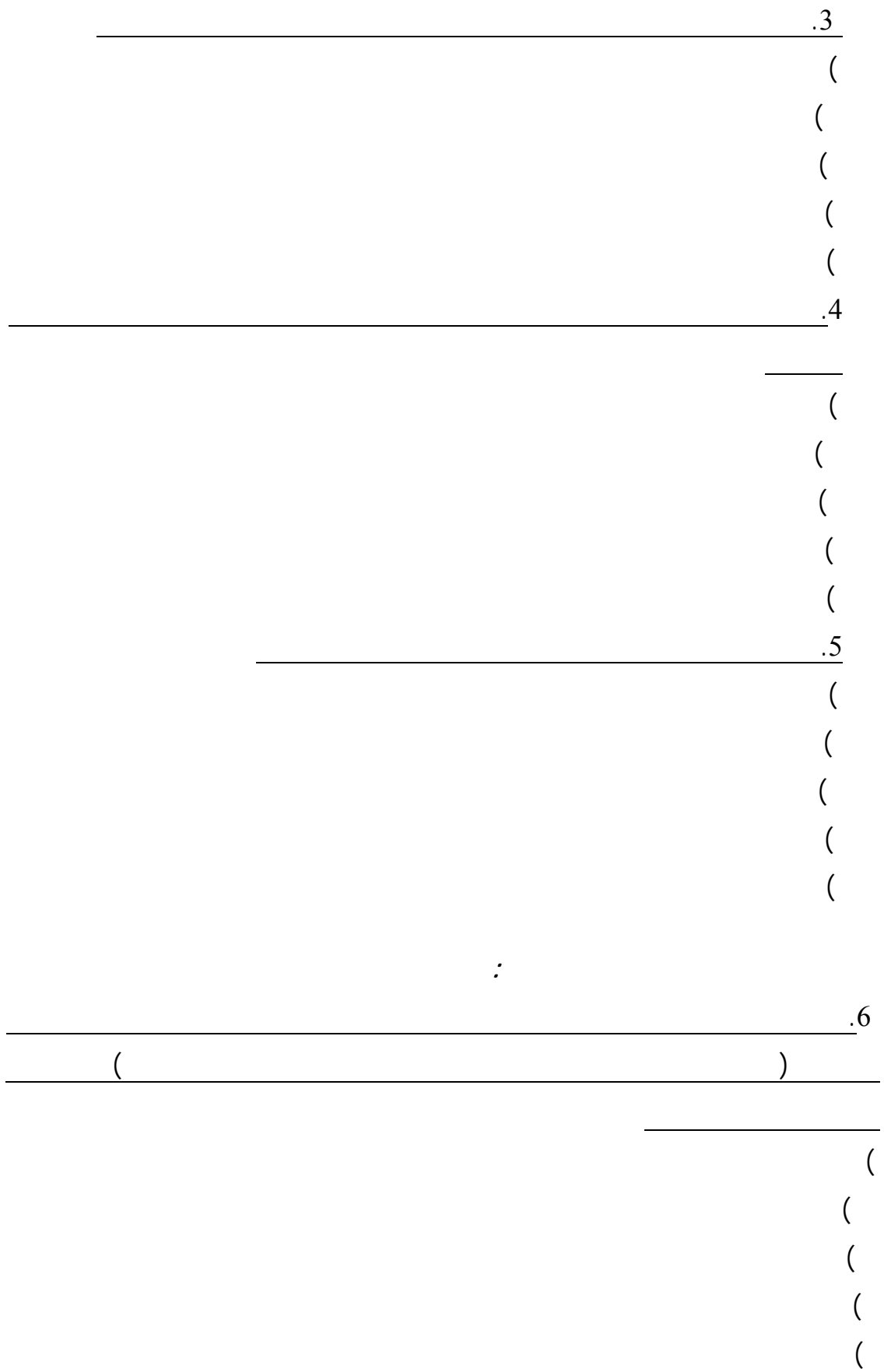
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Annex (3)

Participant letter

.....\.....\ 2007

Dear participant

I wish to carry out a research project to study shoulder pain among paraplegics patients who are using manual propelled wheelchairs in Gaza Strip: A Survey study.

I cordially invite you to participate in this study if you please. The duration of the study is 8 months.

- You do not have to take part if you don't want to. If you do not take part in the study, this will not affect your identity in anyway.
- If you decide to participate in this study, you will be interviewed by the researcher to talk with him and fill the questionnaire which will be filled by the pen's of the researcher.
- All the data which will collect from you will consider confidential.
- The researcher will be present to you any information you need regarding this study, and you can call me by mobile number 0599-883113

Many Thanks

Yours sincerely

Researcher, Jadallah M. El-Shafie

Annex (4) **Questionnaire**

A-Demographic data:

- Address:**.....
- Birth date:**...../...../.....
- Age:**.....
- Gender:** Male Female
- Marital Status:** Married Single Divorce Widowed
- Date of injury**//
- Rehabilitation period**/...../.....
- Period of inpatient rehabilitation**
- Level of education**
Primary Secondary University prep
- Occupation before injury**.....
- Occupation after injury**
- Income (financial situation)**
Less than 1000 NIS Less than 1500 NIS
Less than 2000 NIS Less than 2500 NIS
- Living area**
City Camp rural Town
- Home situation:**.....
- Previous medical history:**

B)Wheelchair User’s Shoulder Pain Index

During the past week, how much shoulder pain did you experience when:

1. Transferring from a bed to a wheelchair?



2. Transferring from a wheelchair to a car?



3. Transferring from a wheelchair to the tub or shower?



4. Loading your wheelchair into a car?



5. Pushing your chair for 10 min or more?



6. Pushing up ramps or inclines outdoors?



7. Lifting objects down from an overhead shelf?



8. Putting on pants?



9. Putting on a T-shirt or pullover?



10. Putting on a button-down shirt?



11. Washing your back?



12. Performing usual daily activities at work or school?



13. Driving?



14. Performing household chores?



15. Sleeping?



Subjects answered each question by marking an “X” on a 10-cm visual analog scale anchored at “no pain” to “worst pain ever experienced.” If a question did not apply, subjects were asked to mark “NA.”

C) Shoulder Rating Questionnaire

Please answer the following questions regarding the shoulder for which you have been evaluated or treated. If a question does not apply to you, leave that question blank. If you indicated that both shoulders have been evaluated or treated, please complete a separate questionnaire for each shoulder and mark the corresponding side (right or left) at the top of each form.

1. Considering all the ways that your shoulder affects you, circle a number on the scale below for how well you are doing.

Very poorly { 1 2 3 4 5 6 7 8 9 10 } Very well

The following questions refer to pain.

2. During the past month, how would you describe the usual pain in your shoulder at rest?

- A) Very severe
- B) Severe
- C) Moderate
- D) Mild
- E) None

3. During the past month, how would you describe the usual pain in your shoulder during activities?

- A) Very severe
- B) Severe
- C) Moderate
- D) Mild
- E) None

4. During the past month, how often did the pain in your shoulder make it difficult for you to sleep at night?

- A) Every day
- B) Several days per week
- C) 1 day per week
- D) Less than 1 day per week
- E) Never

5. During the past month, how often have you had severe pain in your shoulder?

- A) Every day
- B) Several days per week
- C) 1 day per week
- D) Less than 1 day per week
- E) Never

The following questions refer to daily activities.

6. Considering all the ways you use your shoulder during daily personal and household activities (e.g. dressing, washing, driving, household chores), how would you describe your ability to use your shoulder?

- A) Very severe limitation; unable
- B) Severe limitation
- C) Moderate limitation
- D) Mild limitation
- E) No limitation

Questions 7–11: During the past month, how much difficulty have you had in each of the following activities due to your shoulder?

7. Putting on or removing a pullover sweater or shirt

- A) Unable
- B) Severe difficulty
- C) Moderate difficulty
- D) Mild difficulty
- E) No difficulty

8. Combing or brushing your hair

- A) Unable
- B) Severe difficulty
- C) Moderate difficulty
- D) Mild difficulty
- E) No difficulty

9. Reaching shelves that are above your head

- A) Unable
- B) Severe difficulty
- C) Moderate difficulty
- D) Mild difficulty
- E) No difficulty

10. Scratching or washing your lower back with your hand

- A) Unable
- B) Severe difficulty
- C) Moderate difficulty
- D) Mild difficulty
- E) No difficulty

11. Lifting or carrying a full bag of groceries (8–10 lb)

- A) Unable
- B) Severe difficulty
- C) Moderate difficulty
- D) Mild difficulty
- E) No difficulty

The following questions refer to recreational or athletic activities.

12. Considering all the ways you use your shoulder during recreational or athletic activities (eg, baseball, golf, aerobics, gardening), how would you describe the function of your shoulder?

- A) Very severe limitation; unable
- B) Severe limitation
- C) Moderate limitation
- D) Mild limitation
- E) No limitation

13. During the past month, how much difficulty have you had throwing a ball overhand or serving in tennis due to your shoulder?

- A) Very severe limitation; unable
- B) Severe limitation
- C) Moderate limitation
- D) Mild limitation
- E) No limitation

14. List one activity (recreational or athletic) that you particularly enjoy and then select the degree of limitation you have, if any, due to your shoulder :Activity

- A) Very severe limitation; unable
- B) Severe limitation
- C) Moderate limitation
- D) Mild limitation
- E) No limitation

The following questions refer to work.

15. During the past month, what has been your main form of work?

- A) Paid work (list type of work) _____
- B) Housework
- C) Schoolwork
- D) Unemployed
- E) Disabled due to your shoulder
- F) Disabled secondary to other causes
- G) Retired

If you answered D, E, F, or G to the above question, please skip questions 16–19 and go on to question 20.

16. During the past month, how often were you unable to do any of your usual work because of your shoulder?

- A) All days
- B) Several days per week
- C) 1 day per week
- D) Less than 1 day per week
- E) Never

17. During the past month, on the days that you did work, how often were you unable to do your work as carefully or as efficiently as you would like because of your shoulder?

- A) All days
- B) Several days per week
- C) 1 day per week
- D) Less than 1 day per week
- E) Never

18. During the past month, on the days that you did work, how often did you have to work a shorter day because of your shoulder?

- A) All days
- B) Several days per week
- C) 1 day per week
- D) Less than 1 day per week
- E) Never

19. During the past month, on the days that you did work, how often did you have to change the way that your usual work is done because of your shoulder?

- A) All days
- B) Several days per week
- C) 1 day per week
- D) Less than 1 day per week
- E) Never

The following questions refer to satisfaction and areas for improvement.

20. During the past month, how would you rate your overall degree of satisfaction with your shoulder?

- A) Poor
- B) Fair
- C) Good
- D) Very good
- E) Excellent

21. Please rank the 2 areas in which you would most like to see improvement (place a 1 for the most important, a 2 for the second most important).

Pain _____

Daily personal and household activities _____

Recreational or athletic activities _____

Work _____