ANALYSIS OF PAIN DURING SMARTPHONE USE IN SITTING POSITION IN THE ELDERLY

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2021

การวิเคราะห์อาการปวดขณะใช้งานสมาร์ทโฟนในท่านั่งในผู้สูงอายุ

ภิญญา ภูปภัสศิริ

ปริญญานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตร
วิทยาศาสตรมหาบัณฑิต สาขาวิชากายภาพบำบัด
คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ
ปีการศึกษา 2564

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PHINYA PUPAPASSIRI

A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of MASTER OF SCIENCE

(Physical Therapy)

Faculty of Physical Therapy, Srinakharinwirot University

2021

THE THESIS TITLED

ANALYSIS OF PAIN DURING SMARTPHONE USE IN SITTING POSITION IN THE ELDERLY

BY

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HAS BEEN APPROVED BY THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF SCIENCE IN PHYSICAL THERAPY AT SRINAKHARINWIROT UNIVERSITY

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Degree MASTER OF SCIENCE

Academic Year 2021

Thesis Advisor Assistant Professor Dr. Pattariya Intolo

Presently, smartphone and internet usage in elderly people is continually increasing. Investigating the proper posture during smartphone use is vital to prevent musculoskeletal pain. The purpose of the current study was to compare severity of pain and the numbers of location of pain among 3 sitting postures which were preferred sitting posture (preferred sitting), sitting upright and holding the smartphone with two hands at chest level with no elbow support (no elbow support), and sitting upright with elbow support and holding the smartphone with two hands at chest level (elbow support) in smartphone use for 15 minutes in the task of watching video with no texting. Participants were elderly groups aged 60-69 years old which were assigned to use smartphones in random order of three positions. Body pain chart and Visual analog scale (VAS) were used to evaluate location of pain and severity of pain, respectively. Results showed that 1) Pain at neck, shoulder, upper back and lower back area in “preferred sitting” was significantly higher than in other two postures ($p<0.05$). 2) Pain at shoulder and arm areas in “no elbow support” was significantly higher than in “elbow support” ($p<0.05$). 3) There was no pain in all areas of “elbow support”. 4) The most painful areas recorded are the neck and shoulder regions. In summary, pain in “elbow support” was lesser than in other two postures. Therefore, the researcher recommends elderly group use smartphones in sitting upright postures with elbow support to prevent musculoskeletal pain caused by smartphones.

Keyword : Smartphone, Health, Aging, Pain, Posture

ACKNOWLEDGEMENTS

I am deeply grateful to my major advisor Asst. Prof. Dr. Pattariya Intolo for her recommendations, and helpful assistance to polish my current way of thinking into greater knowledge.

I am deeply thankful to the Faculty of Physical Therapy, Srinakharinwirot University for supporting the research funds (Research fund from the income of the Faculty of Physical Therapy of year 2022).

I am deeply thankful to the Faculty of Science and Technology, Loei Rajabhat University for giving me a chance to disseminate this research in “The 4th National Conference on Science, Technology and Innovation 2022”

I would like to thank Mr. Chavapon Pupapassiri for helping me in the research process and I also would like to thank all volunteers for participating in this study. I would further like to thank my family in supporting me.

Lastly, thank you to all the staff at the Faculty of Physical therapy and Graduate school of Srinakharinwirot University for helping in the paperwork process.

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CHAPTER 1
INTRODUCTION

Background

The smartphone is one of the most important IT devices in daily life. It can be used in a variety of ways to facilitate users' communication needs and internet usage.[1-3] There are 67% smartphone worldwide users and approximately 59% of internet users spend long periods of time surfing the internet, with an average time of 6 hours and 43 minutes per day.[4] Thai people use the internet on average of approximately 10 hours and 22 minutes per day. About 91.2% of smartphone users use the smartphone for social networks including Facebook, Line, and Instagram, where about 95.7% of smartphone users use it at home.[5, 6]

Interestingly, smartphone and internet usage in elderly people is continually increasing. The reason for increasing of the internet media use is the easy access to information.[7, 8] In the United States, elderly groups use the internet via the smartphone, which increased from about 68% of elderly people from 2019 to 2011.[9] In Thailand, elderly people also have the trend of increasing internet usage from 2013 to 2018.[10] Surprisingly, elderly people in Thailand also increased the length of time spent on the smartphone. Likewise, Electronic Transactions Development Agency (ETDA) found that elderly people in Thailand in the age group of 55-73 years old used the internet on average of approximately 10 hours per day in 2019,[6] an increase of 5 hours 46 minutes per day in 2016.[11] The most popular online activities are social communication (82.5%), online searching (69%), reading books / online articles / news (67.5%).[12] It was found, Thai elderly who were between 60-69 years old have been using the Internet for more than 5 years (33.3%). However, elderly who were between 70-79 years old and 80 years old or up did not or rarely use the internet. Most elderly people (49.6%) had used smartphones or tablets for more than a year but less than five years in 2019. Some elderly used the internet every day. The report also showed that the elderly used the internet for approximately 30 minutes per time, where elderly males spent time on the internet more than elderly females for about 1-2 hours per day. Many 60-69 years (40%) old spent half an hour on the internet and they enjoyed using the internet in evening.[13] The majority of elderly people used smartphones (92.5%) more than tablets (9.2%). They spent time on the internet by their devices for more than an hours per day. Elderly people commonly use the internet before sleep (85.3%), evening (52%), afternoon (37.3%) and morning (42.4%). Interestingly, they use the smartphone mostly in the living room (76.9%), in the bedroom (67.3%), at a restaurant (30%), in the bathroom (22.2%), at the workplace (26.3%) and in the car as a passenger (15.9%).[14]

Musculoskeletal pain was found in elderly group cause of smartphone use. The self-pain assessment survey of Chulalongkorn university states that smartphone users aged 65 years and over have pain at neck or shoulder (48.6%), lower back (22.4%), wrists (38.4%), and eyes (32.2%) especially, in persons who use smartphones for long periods of time and displayed an increase in muscle pain or eye pain.[14] Area of pain caused by smartphone use in the elder group is similar to an other age group which found that users experienced pain at neck[15-18], upper back, lower back, shoulder, forearm, and wrist.[16, 19-26] Using smartphones in the elderly group not only has an effect on musculoskeletal pain severity, but also has an adverse effect on general health.[14] The survey of Khonkhan university found that Thai elderly people reported that eye pain was produced from spending extended periods of time on the internet.[13] However, using smartphone in the elder group has a bright side. The elderly smartphone group mentioned that they benefited from a better social life because they communicate by social networks. In contrast, overuse of smartphones can decrease the amount of time spent in developing face-to-face social relationships and in engaging in social activity. In addition, sharing photos and stories with other people benefits them as this can cause a decreased stress levels.[14]

Proper posture during smartphone use in children and adults has been evaluated recently. A pervious study found that using a smartphone with sitting upright posture helped to reduce neck pain and less neck and shoulder muscle activity.(27)

In addition, neutral neck posture or slightly was recommended because the more neck flexion induced the more stresses on cervical spine, muscles and joints,(27) which was the cause of neck pain.(28) It was found that using a smartphone at 60 degrees of neck flexion caused the most neck pain when compared to less neck flexion.(25, 29) Sitting upright is one of the most vital instructions in preventing pain during smartphone use as it induces good spinal alignment from pelvic to lumbar, thoracic and neck vertebrae.(30-33) It was reported that sitting upright during smartphone use in a university study showed less pain when compared with preferred sitting posture which was often seen in slouched posture.(34, 35) This result was also found in children.(15) In addition, to prevent shoulder pain, supporting elbow reduced muscle activity because of the relaxed shoulders and arms during use smartphone in adolescent to adults.(25, 28) The user was able to relax there shoulder and arm on the provided supportive device. Moreover, holding a smartphone with both hands showed less muscle activity of the upper trapezius(28, 36-39) and hand muscles.(28, 36-40) So, upright sitting posture, neutral or slight neck flexion, holding the smartphone with both hands and supporting elbow can reduce pain and risk of musculoskeletal problem in smartphone users.(25, 27-29, 34-41)

Previous studies found that smartphone users aged 18 to 65 years old or over used smartphone in sitting posture more than in standing.(42) In addition, an internet user behavior survey in Thailand shows elderly people often used the smartphone at home (13),especially in the living room.(14) It is also found that using smartphones sitting upright, neutral or slight neck flexion, holding the smartphone with both hands and supporting elbow showed less pain in other age group.

There is a lack of evidence of pain evaluation in the elderly group during smartphone use, even though it is clearly found that there was musculoskeletal pain caused by smartphone use in the elderly group. Therefore, the purpose of this study is to evaluate pain at neck, upper back, lower back, shoulder, arm, wrist, and hand areas during smartphone use in the elderly age group 60-69 years old after smartphone use for 15 minutes in three sitting postures. The results of this study will be useful to develop a guideline of smartphone use for elderly people to prevent the risk of musculoskeletal pain caused by smartphone use.

Research Questions

What posture will have the least pain and number of locations of pain among 3 sitting postures during smartphone use in the elderly?

Objective

General objective

To study pain during smartphone use in different sitting postures in the elderly.

Specific objective

1.To compare severity of pain among 3 sitting postures which are preferred sitting posture, sitting upright and holding the smartphone with two hands at chest level, and sitting upright with elbow support and holding the smartphone with two hands at chest level in smartphone use for 15 minutes in the elderly group aged 60-69 years old.

2.To defined and compare the numbers of location of pain among 3 sitting postures which are preferred sitting posture, sitting upright and holding the smartphone with two hands at chest level, and sitting upright with elbow support and holding the smartphone with two hands at chest level in smartphone use for 15 minutes in the elderly group aged 60-69 years old.

Research hypotheses

1. The severity of pain in sitting upright and holding the smartphone with two hands at chest level and sitting upright with elbow support will have the least pain when compared with holding the smartphone with two hands at chest level, lower than in preferred sitting posture.

2. The number of locations of pain in sitting upright and holding the smartphone with two hands at chest level and sitting upright with elbow support will have the least pain when compared with holding the smartphone with two hands at chest level, lower than in preferred sitting posture.

Scope of the study

This research will be conducted within 3 sitting postures in the elderly with the age range from 60 to 69 years old who have experience of smartphone use at least 2 days per week and at least 2 hours a day at Nakhon Nayok province, Thailand.

Research Advantages

The researcher expects result of this study could inform the database and develop ergonomic guidelines concerning the use of smartphone in elderly to prevent the risk of musculoskeletal disorders caused by excessive smartphone use.

Conceptual framework

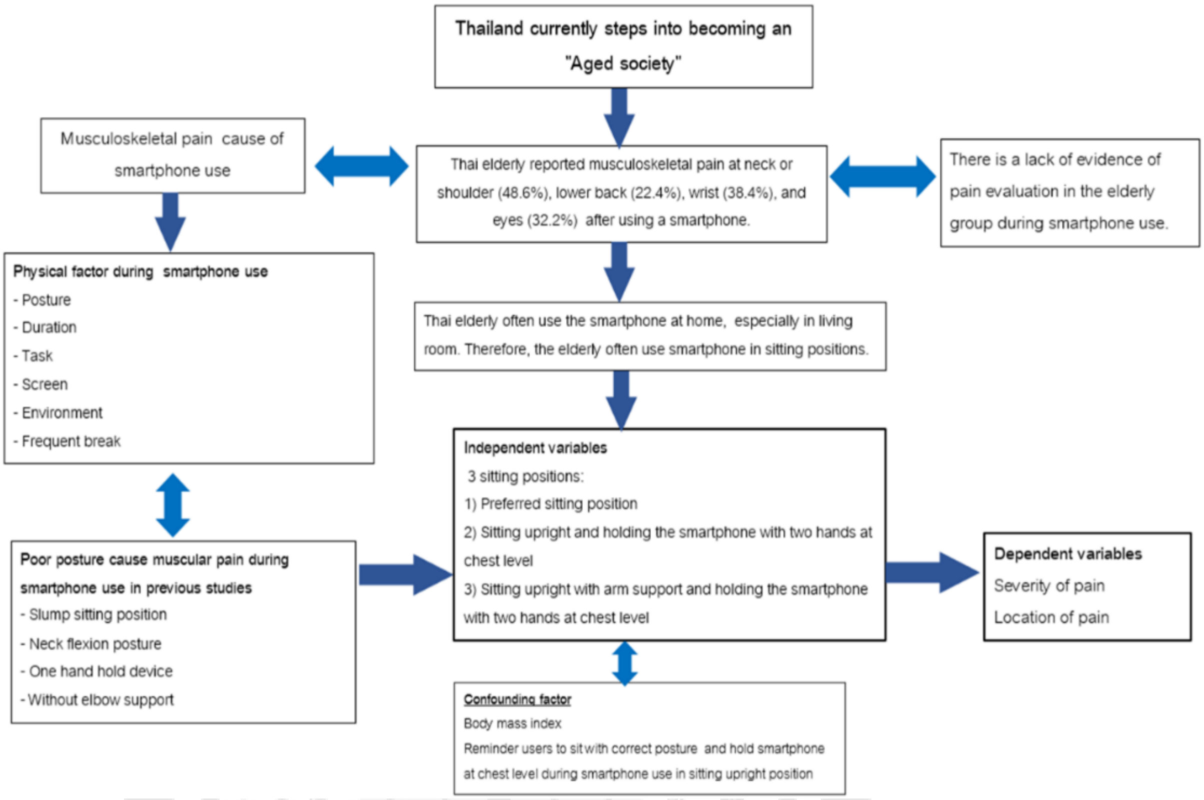


Figure 1 Conceptual framework of this study

CHAPTER 2
LITERATURE REVIEW

This chapter will be presenting the findings of previous studies related to elderly and smartphone behavior. This review will conclude with a picture to develop the protocol of the study which will lead to final results to help elderly use smartphones in proper postures to prevent the risk of musculoskeletal pain. The topic of this review consists of the following issues:

1. Elderly people
2. Cervical and Thoracic postural alignments in sitting of elderly people
3. Smartphone and Internet use (Time and behavior)
4. Musculoskeletal pain caused of Smartphone use
5. Proper posture during Smartphone use

1. Elderly people

1.1 Definition of elderly people

Thailand have classified the group of population as childhood (person who was less than 15 years old), workforce/working-age (person who was between 15- 59 years old) and elderly (person who was 60 years or more).[43] Elderly Person Act which defined elderly means a Thai person who is 60 years old or above is elderly.[44] In addition, Electronic Transactions Development Agency (ETDA) has classified generations for a survey of smartphone usage behavior related to data of internet users in Thailand into 4 age groups: 1) Baby Boomers, people born between the year of 1946 and 1964. They're currently between 55-73 years old, 2) Generation X, people were born between the year of 1965 and 1979/80 and is currently between 39-54 years old, 3) Generation Y or Millennials, people were born between the year of 1981 and 1994/6. They are currently between 19 and 38 years old, 4) Generation Z is the newest generation, born between 1997 and 2012[45] or people who were born from 1997 onward.[6]

The elderly population refers to the proportion of persons aged 65 years or older in the total population. The World Health Organization[40] and the United Nations define an "aging society" as one in which more than 7% of the population is 65 years or older, an "aged society" as a society in which more than 14% of the population is 65 years or older, and a "super-aged society" as a society in which more than 21% of the population is 65 years or older.[46] The aging society is a phenomenon which relates to the rising median age of the population because of declining fertility rates and/or increased life expectancy.[47] Elder group of people increased gradually. In 2019, the global population was 7,713 billion persons, there were 1.1016 billion elderly persons or 13% of the total. Asian member countries had become an aged society as 11% of their combine population was aged 60 years or older (Figure 2).[12]

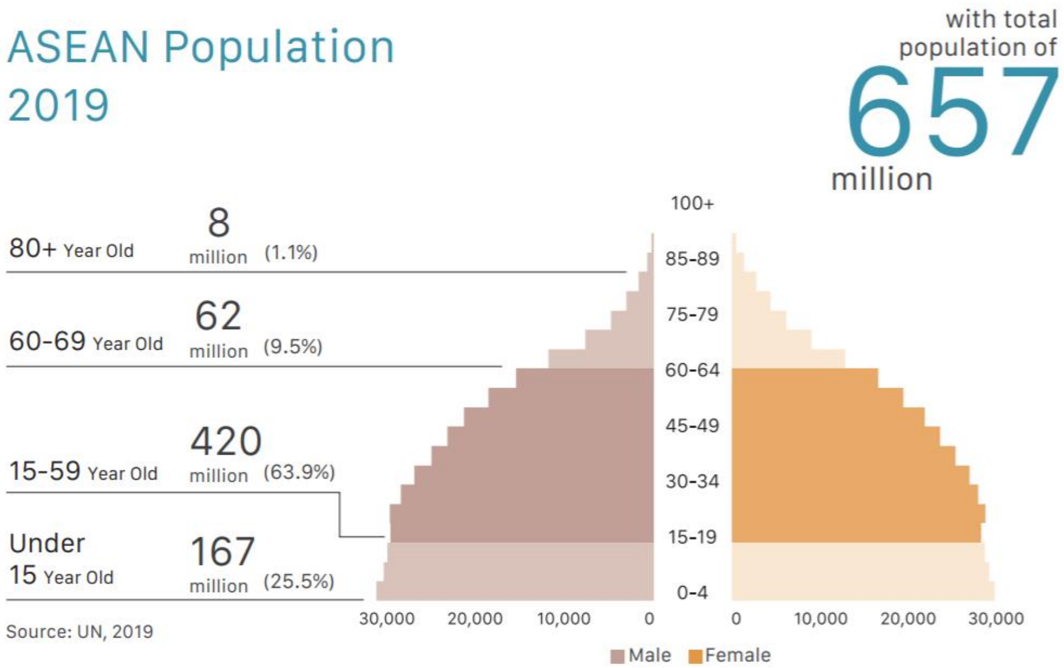


Figure 2 ASEAN population in 2019[12]

WHO (World Health Organization) has classified aging, which a person who is aged 65 to 74 years old is referred to as ‘early elderly’ and a person aged 74 or over referred to as 'late elderly’. Although, elderly is commonly referred to as a person aged 65 years or over.[48-51] Some medical research often defines elderly as people aged 65 years or more, but some studies define elderly as people ranging from 50 to 80 years old due to life expectancy and socio-economic conditions.[52]

1.2 Elderly people in Thailand

Thailand is going to be an elderly society. The National Economic and Social Development Council estimates that there will be 1 million Thais aged 60 years or older in each year in 2023.[12] Thailand is currently step into becoming an "Elderly society" owing to the number of elderly people accounted for 10% of the total population. Accordingly, Thailand has tended to be becoming a "Complete aging society" when the elderly is predicted to be as many as 20% in 2025. The number of elderly people in Thailand has constantly increased each year.[12, 53-55] In 2033, Thailand will become a “super-aged society” when the proportion of the population aged 60 years or older reaches 28% (or the population aged 65 years or older reaches 20%).[12]

In 2019, Thailand had an elderly population about 11.6 million or 17.5% of the total population[12] which increased from the year of 2009.[53] Over the past 30 years, the number of people born in Thailand has steadily decreased. It is important to note that it is likely that the number of births is even lower than the number of deaths. The reduction of birth rates of the Thai population since the late 1960s has declined the portion of the population that is young. This phenomenon is shown in tandem with the increased longevity of Thai people, and that has accelerated the elderly population (Figure 3).[12]

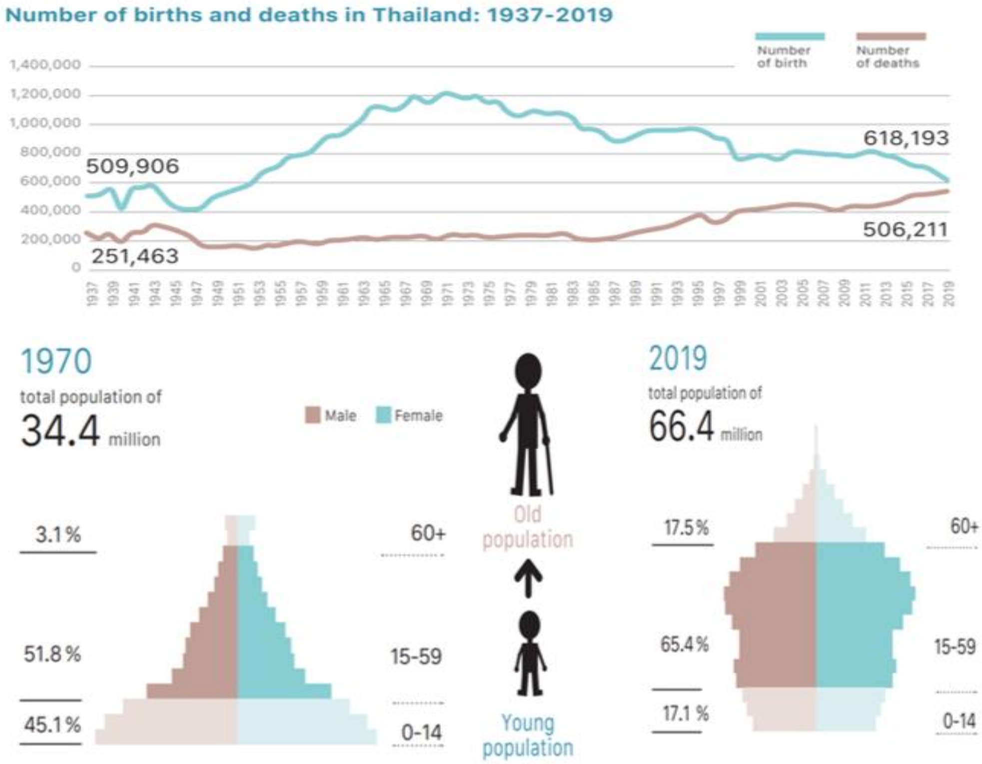


Figure 3 Number of births and deaths in Thailand and Total population in Thailand, 1970-2019[12]

From this review, the current study will evaluate smartphone use in elderly people which is defined between ages 60-69 years old from the survey of smartphone usage behavior related to data of internet user in Thailand (ETDA).[6]

2. Cervical and Thoracic postural alignments in sitting of elderly people

Gong et al, 2019 studied body postural change occurring with aging. Posture neck angle, thorax angle, waist angle, hip angle and knee angles of participants who aged 20-89 years old were measured by using a photogrammetric in standing posture (in sagittal plane). The results showed that the overall trends of neck and thorax angles in participants aged 20-70 years old were similar and it decreased with age, especially in persons aged 50-70 years old. Cervical lordosis and thoracic kyphosis were observed clearly with increasing age, especially in participants aged 50 or over. Participants aged 70 years or above had a slight increase trend of neck angle.(56) Relating to Meng-Jung et al, 2009 it was found that ROM decreased with the increase of age, especially in the cervical spine in participants aged 16-64 years old who measured ROM with motion analysis system. They found that that aging has an effect on ROM particularly in flexion and extension in head, trunk, and hand in participants aged 20-63 years old. These angles were measured with a three-dimensional motion capture system in standing (in sagittal plane).(57) In addition, in elderly people it was observed that head showed bending forward posture.(58)

3.Smartphone and Internet use (Time and behavior)

3.1 Smartphone use in overall

There were 67% smartphone worldwide users and there are 59% of internet users who spend longer times surfing the internet which averaged 6 hours and 43 minutes per day.[4] ETDA found that the number of internet users in Thailand in 2018 was 47.5 million people which is 71.5% of the total population (66.4 million people). The result shows the number of internet users had highly increased to about 81.5% for five years.[5]

Thai people used the internet on average 10 hours and 22 minutes per day and a Compound Annual Growth Rate was 14.8% per year between 2013 and 2019. that means Thai people commonly use the internet in their daily life (Figure 4).[6] The survey shows that people not only in the central region (10 hours 19 minutes/day) spent time on the internet, but people in the Northern region also use the internet (10 hours 31 minutes/day), Northeastern region (10 hours 28 minutes/day) and South region (10 hours 17 minutes/day) spent time with internet also. Approximately 91.2% of internet users spent longer time surfing the internet for Facebook, Line and Instagram, most users were among 19–35-year-olds (10 hours 36 minutes/day). The place to use the internet was the house with 95.7%.[6]

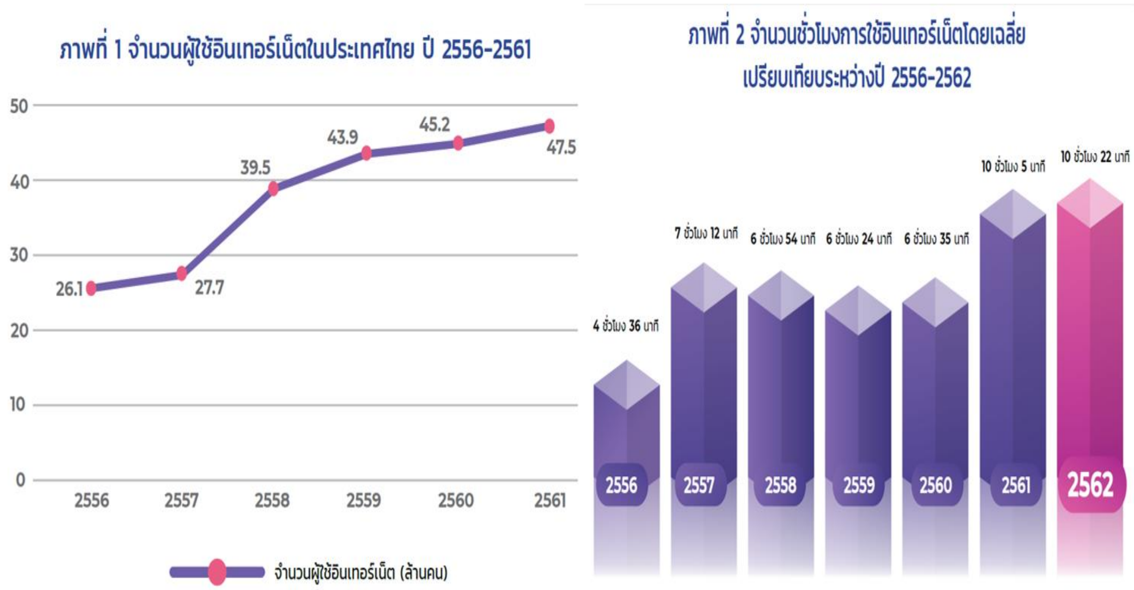


Figure 4 The number of internet users in Thailand during 2013-2018 (Left) and the comparison of the average number of hours spent on the internet during 2013-2019 (Right)[6]

3.2 Smartphone use in elderly people

The United States survey found that elderly people using the Internet via smartphones in 2019 was higher than that of in 2011.[9] A Swiss survey showed that the elderly commonly use the internet in their daily life (63%). Elderly people, age group between 65 and 69 years use the internet about 79.3% whereas older age groups over 85 years old use the internet about 12.9%. Elderly males (56.1%) use the Internet more than elderly females (43.9%). They found that elderly people use internet by using smartphone (32%) and tablet (26%). Elderly group use the internet via smartphone and tablet in different numbers with 65-69 years old (50.2%), 70-74 years old (31.5%), 75-79 years old (13.3%), 80-84 years old (3.9%) and 85 years or older (1%). Elderly groups use mobile internet for email, general information search, navigation, train connections search, and reading newspapers and a few uses of mobile Internet for online banking, multimedia content, online shopping, social networks, or other uses. Not surprisingly, elderly people who use mobile Internet have greater technological affinity and were using a computer regularly before retirement. Interestingly, 93% of internet users in this study agreed with the message "The Internet allows me to stay independent for a longer period of time in old age", and 61% of internet users agree with the message "With my smartphone, I can better organize my life". Therefore, smartphone use with mobile Internet is perceived as a resource for coping with daily life in elderly people.[59]

Thailand survey by ETDA reported that Baby Boomers in Thailand who were 55-73 years old used internet on average 10 hours a day. They use the internet in weekdays for 9 hours 35 mins and 11 hours 3 min in weekend. The most popular online activities are social communication (82.5%), online searches (69%), and reading books / online articles / news. (67.5%).[6] Interestingly, in 2001 Baby Boomers spent time on the internet 3 hours per day but in 2019, they spend time on the internet 10 hours per day, so the result form the survey between year 2001 to 2019 shows Baby Boomers have highly increase their time with internet (Figure 5).[5, 6, 11, 60, 61]

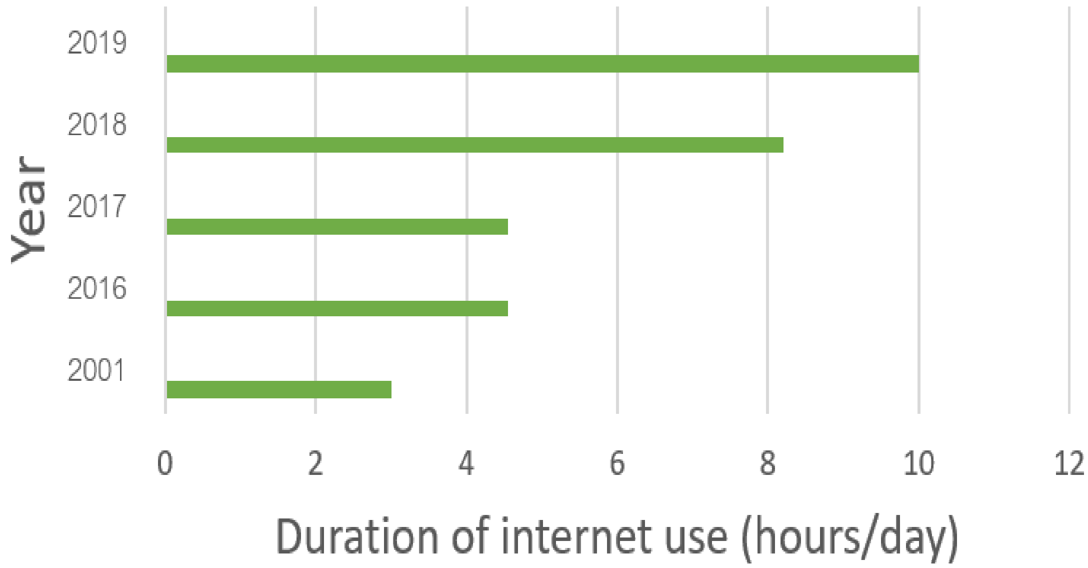


Figure 5 The comparison of the average number of hours spent on the internet of Thai Baby Boomers during 2001-2019[6]

The survey in Thailand also found that Thai people aged 65 years old or older used the internet by using smartphone in the duration of 3 hours per day and 49.6% of them had experience in smartphone use for more than a year but less than five years. The top three applications were social network (53.1%), photo and video recording (36.1%) and games (21.8%). The elderly commonly used the internet before sleep (85.3%), in the evening (52.0%), and in the morning (47.6%). They use smartphone in living room (76.9%), in their bedroom (67.3%) and in a restaurant (30.4%) (Figure 6).[14]

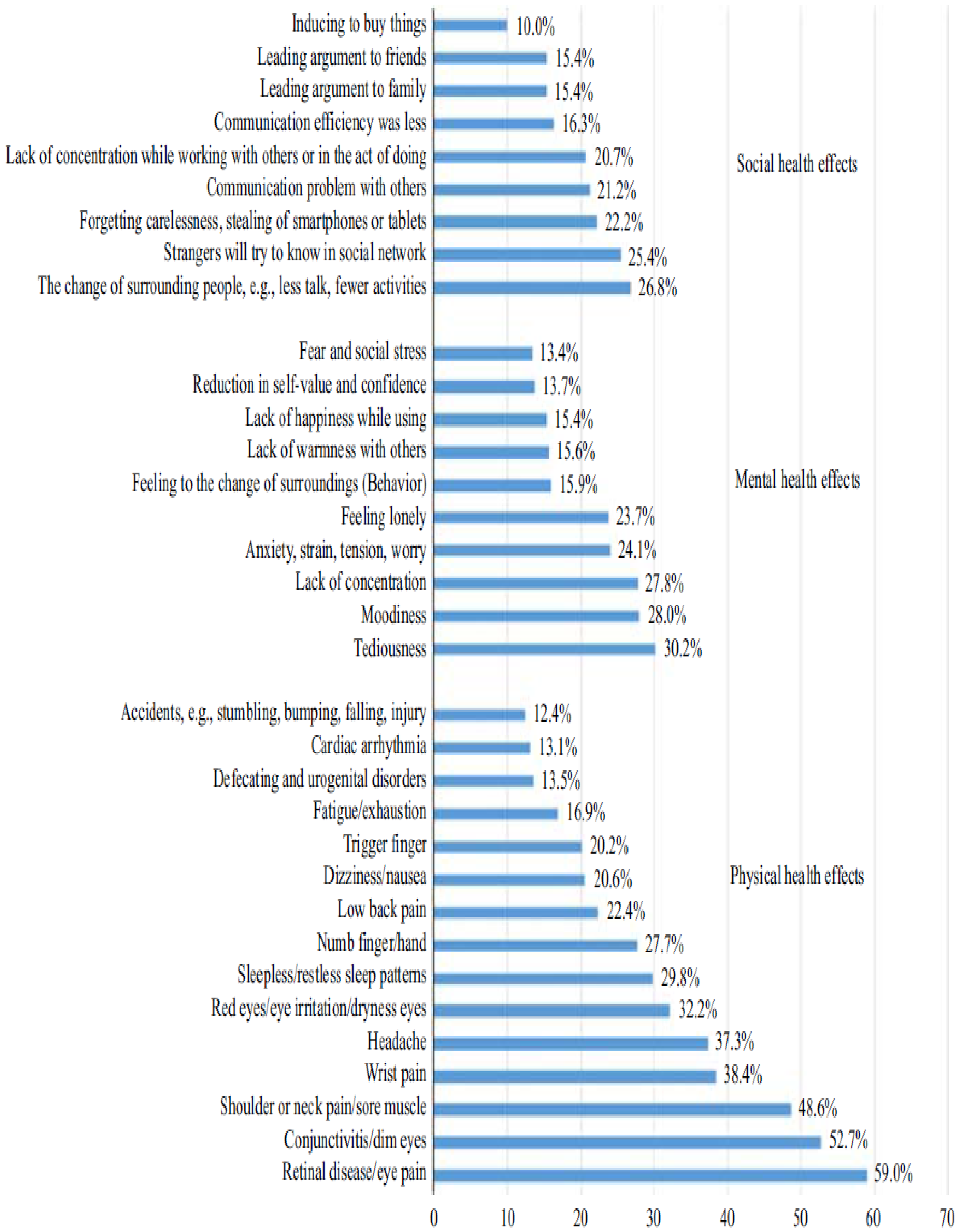
The behavior of smartphone and tablet use	Number ($n = 490$)	Percentag
When used		
Morning	233	47.6
Late morning	208	42.4
Noon	171	34.9
Afternoon	183	37.3
Evening	255	52.0
Late evening	177	36.1
Night	174	35.5
Before sleep	418	85.3
Types of applications		
Social networking, e.g., Line, Facebook, BeeTalk, Twitter, Skype	260	53.1
Photo and Video, e.g., YouTube, Camera, Instagram, FotoRus	177	36.1
Games, e.g., Line Let's Get Rich, Shoot Dinosaur	102	20.8
Music, e.g., Full Mp3	59	12.0
Lifestyle, e.g., 7-Eleven TH, Lazada	58	11.8
Productivity, e.g., Gmail, Pages, Numbers	72	14.7
Finance, e.g., Mobile Banking	45	9.2
Travel, e.g., AirAsia, Nok Air, Lion Air	201	41.0
Places of using devices		
In the living room	377	76.9
In bedroom	330	67.3
At restaurant	149	30.4
In the backyard	141	28.8
At the workplace	129	26.3
In the bathroom	109	22.2
In car as passenger (commute)	78	15.9
While driving	21	4.3

Figure 6 The behavior of smartphone uses in elderly group in Thailand[14]

Furthermore, elderly people who were between 60-69 years old used the Internet for more than 5 years (33.3%), whereas elderly people age between 70-79 years old and 80 years old or upper did not or rarely use the Internet in 2014. Most elderly people did not have the exact Internet using time and some elderly used the internet every day. They use the internet for approximately 30 minutes each time where male elderly spend time on the internet more than female elderly about 1-2 hours. About 40% of users aged 60-69 years old use the internet 30 minutes and enjoyed using the internet in the evening and some of them enjoyed using the internet in the afternoon but there was no report that elderly used the internet at night. Elderly aged 60-69 years old and 70-79 years old used the internet at home (81.8%).(13)

Most elderly (66.7%) learned how to cope with this new technology by the assistance of their young age group, while 48.5% of them learned to use the Internet by themselves. Their main purpose to use the internet was entertainment (57.6%) such as watching video. 60-69 years old enjoyed searching what they were interested in (63.3%), while in most 70-79 years used the Internet for social interaction, for searching the information and news, and for their own entertainment (33.3% equally in every activity). Elderly aged 60-69 years old liked to use the internet for enjoyment with themselves, while elderly aged 79-79 liked to use the internet for sharing news or online entertainment with their family member. The main reason for using the internet was to search for information (63.6%), it was an effective tool for communication (51.5%). Nevertheless, elderly group (60-69 years old and 70-79 years old) agree that the internet was easy to use and really helped them to communicate conveniently and quickly.(13)

Moreover, it was clearly found that elderly people in Thailand have increased the length of time they spend on mobile communication devices resulting in this growing group of the nation’s population being at risk of several serious health effects (Figure 7).(14)



Note: n=490

Figure 7 The health effects from smartphone use in elderly group(14)

4. Musculoskeletal pain caused of Smartphone use

Thorburn in 2021 found that smartphone user aged 18 to 65 years or over reported musculoskeletal symptoms during or after device use. The symptoms have tended to increase in frequency up to device usage. Most internet users begin to have symptoms within the first 15 minutes of using device (26.2%), or within the 15-30 minutes time period (38.3%).[42]

Wilaiwan and Siriwong in 2019 clearly showed that smartphone use in elderly persons aged 65 years and over had health effects including physical, mental, and social health. They found that elderly people who used the devices for more than an hour per day had experienced an increase in physical and social health effects. For physical health effects, elderly people had pain at neck or shoulder (48.6%), lower back (22.4%), wrist (38.4%), and eyes (32.2%) especially in persons who use a smartphone for longer periods of time, inducing muscle pain or eye pain.[14] Loipha in 2014 found that elderly group reported eye pain caused by spending more time on the internet.[13] Interestingly, elderly groups who regularly rested their eyes before continuing to use their device experienced a statistical reduction in physical health effects compared to those who did not rest their eyes.[14] However, using smartphone has a good side effect for elderly people. Thai elderly people reported that they had a good social health side effect form smartphone use because they could communication via social networks, although in contrast overuse of smartphones decreased the amount of time spent in developing face-to-face social relationships and engaging in social activity. Furthermore, elderly people have good mental health because they were able to share photos with other people such as friends and family which helped reduce stress.[14]

From a literature review above, Thailand has currently stepped into an "Elderly society" owing to the number of elderly people accounted for 10% of the total population. Thailand had an elderly population 17.5% of the total population in 2019,[12] that means Thailand is currently an Elderly society. The increase of the elderly in the population showed a similar trend in increase in using the internet in the elderly group. ETDA’s survey showed that from 2013 to 2018, Baby boomers aged 55 to 73 years old tended to increase internet using. A previous study found that adverse health effects of internet use on physical, mental, and social health in elderly. Elderly had muscular pain or eye pain in persons after smartphone use for longer periods.(13, 14) This finding is similar to other age groups which found that pain was reported because of smartphone use. (16-18, 21, 24-26)

The increasing number of elderly population and time to use internet can become a problem in the future. However, there are a lack of guidelines of smartphone use for elderly. Evaluation of pain during smartphone use can help to prevent the risk of musculoskeletal pain caused by smartphone use and develop guidelines of smartphone use for elderly.

5. Proper posture during Smartphone use

Currently, there is no study for the proper postures for elderly in smartphone usage. However, Thai elderly often use the smartphone at home[13], especially in living room.[14] Therefore, the elderly often use smartphone in sitting posture. Previous studies evaluations in other age groups found that posture, duration, frequency, and tasks of smartphone use were risk factors of musculoskeletal disorders.[62] Posture during smartphone use has been in many studies.[25, 26, 28, 29, 34-39, 63, 64] A good posture for using smartphones is upright sitting posture, neutral or slight neck flexion, holding the smartphone with both hands and supporting elbow.[34, 35] Sitting upright, holding the smartphone with two hands is recommended in university student and adults because it showed less pain in this posture during smartphone use.[34, 35]

5.1 Sitting upright

Smartphone was used in sitting posture. In 2021, Thorburn found that people aged 18 to 65 years or over use smartphone in sitting posture (55.8%) more than standing (49.5%).[42] Liang et al, 2016 observed passengers aged among 20-60 years old and above. who travel by public transportation use mobile phone. All passengers use mobile phone with both hand holds while sitting (23.9%). Passengers who were sitting and using their mobile phone, the most frequent body posture was having trunk against the backrest with elbow support and both feet on the floor (31.6%), followed by a similar posture but free from elbow support (26.6%).[65]

Sitting upright was effective in preventing pain during smartphone use. Previous studies evaluated pain in sitting upright on a chair and placed their feet on the floor compared with participants who sat with preferred posture in smartphone using. The results showed that after used smartphone for 20 minutes, overall pain in sitting upright posture was significantly lower than that of in preferred sitting which was in a slouched posture. In addition, Electromyography (EMG) of erector spinae and upper trapezius in sitting upright was significantly lower than preferred sitting posture after smartphone use for 20 minutes (Figure 8).[34] In addition, sitting upright during smartphone use with two elbows support showed less pain. Pain at neck and shoulder areas was less than 0.2 and 0.7 respectively in total pain scale of 10 and after smartphone use for 20 min. Pain was less than 0.3 at upper back and 0.01 at hands (Figure 9).[35]

Figure 8 Smartphone in preferred and upright sitting[34]

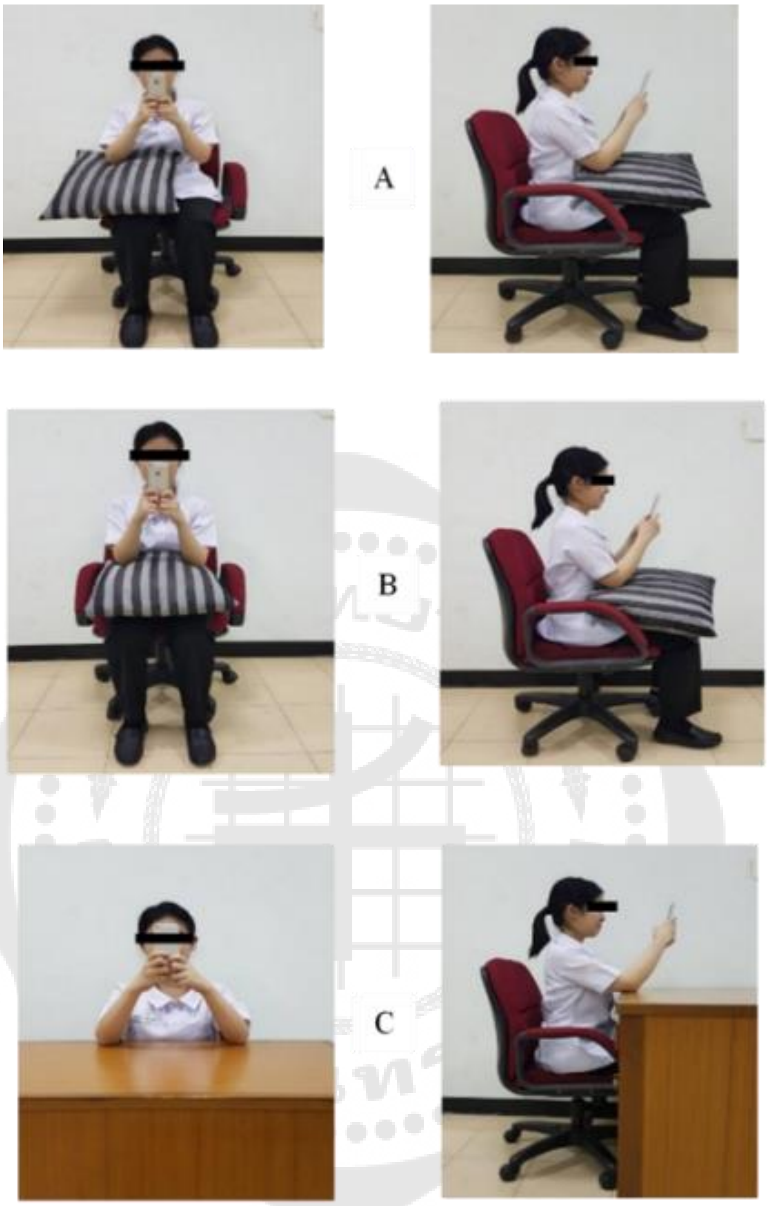


Figure 9 Sitting upright in different postures during smartphone use (A) One elbow support, (B) two elbows support, (C) desk support[35]

Smartphone users in a sitting upright posture showed a reduction of neck pain, neck, and shoulder muscle activity. Normal spinal curvature of cervical lordosis, thoracic kyphosis, and lumbar lordosis provide a good distribution of load on spine. Sitting posture in preferred sitting often in slouch posture because posterior tight muscles are stretched in sitting and pulled on the pelvis tilt.[66] In addition, thigh-trunk angle decreases in sitting posture which caused reduction of the lumbar lordosis when compared to standing posture. Therefore, sitting posture is important to remind users to adjust their spine upright to prevent the risk of musculoskeletal pain. In sitting upright posture, the force through the lumbar curve is less than in slouch sitting posture which has posterior pelvic tilting and less lumbar lordosis.(66) Related to the study found, while seated there will be an increase in load on the muscles and discs, causing the pelvis tilts backwards and reduction of the lumbar lordosis (Figure 10).(27)

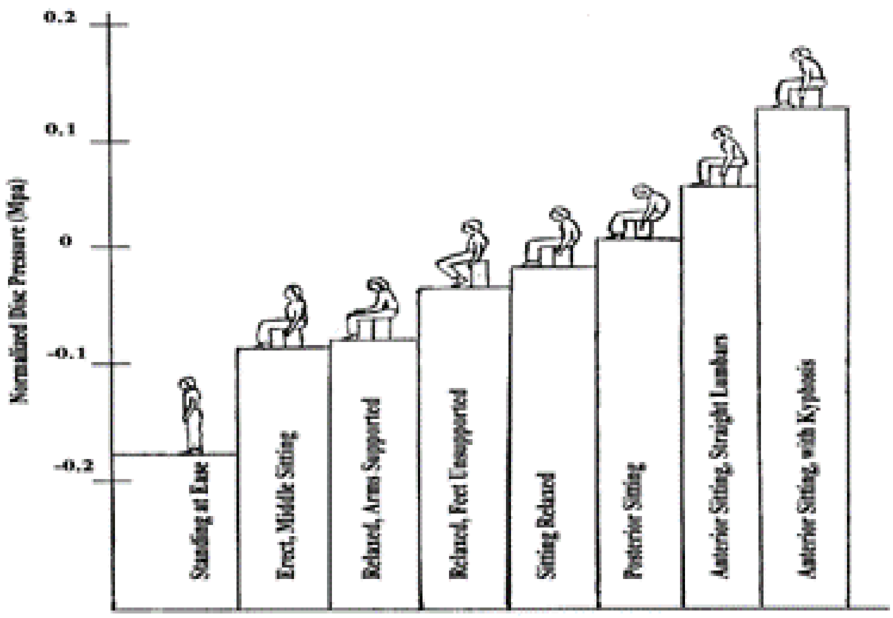


Figure 10 Disc-pressure findings in unsupported sitting(27)

Sitting posture affects the lumbar lordosis. In 2010, Caneiro et al studied in 20 participants were seated in three different postures: 1) slump Sitting, 2) lumbo-pelvic Upright Sitting, and 3) thoracic Upright Sitting (Figure 11).(67) The results showed that slump Sitting caused increase neck flexion, thoracic flexion and lumbar flexion (Hypolordosis) and increased muscle activity of Cervical Erector Spinae. In Lumbo-pelvic Upright posture can be decrease neck flexion, thoracic flexion and lumbar flexion (Normal lordosis) and decrease muscle activity.(67) Related to the study shows, in slouch posture caused increase cervical extensor activity and increased load on cervical spine more than Lumbo-pelvic neutral posture.(68)

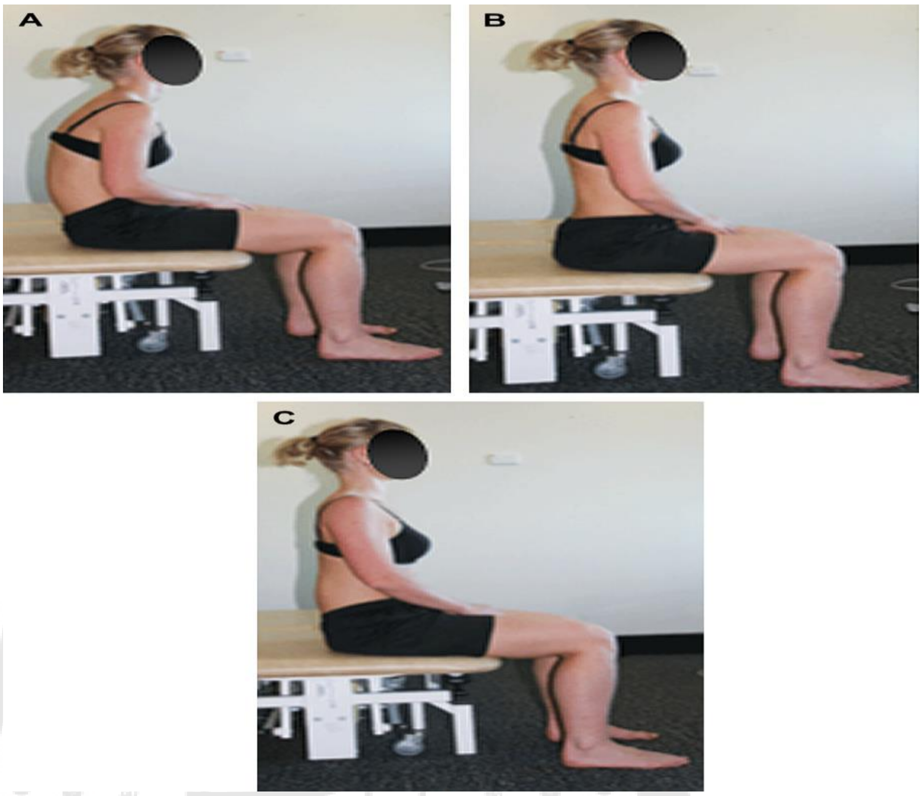
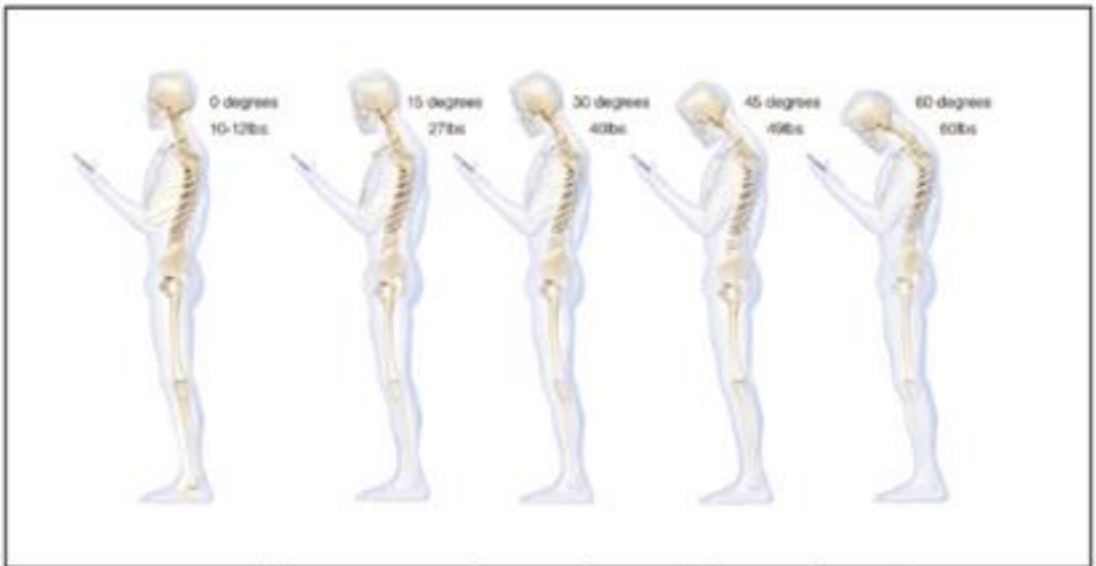


Figure 11 Thoraco-lumbar sitting postures: (A) Slump sitting, (B) Lumbo-pelvic sitting, (C) Thoracic upright sitting[67]

In sitting good posture, the pelvic, lumbar, thorax, and neck region are in neutral postures, which has the less load on the lumbar region, thorax, and cervical spine and muscle activity of back and neck muscles. So, sitting in a good posture will be prevent the risk of musculoskeletal problems.[27, 67-70]

5.2 Neutral or slight neck flexion

Neck flexion angle effected on load on spine. Gustafsson et al, 2011 found that participants aged 19-25 years old who had a neutral head posture had lesser muscle activity of Trapezius muscles in sitting with when compared with other neck flexion postures in the task of texting a message of 300 characters on a mobile phone and with a than other postures.[28] This finding related to Dennerlein et al, 2015 which showed smartphone user in sitting upright with less neck flexion reduced pain at neck and shoulder regions.[20] In addition, Hansraj, 2014 found that a load on the cervical spine increased various degrees of neck flexion. Force to the cervical spine was 10-12 pounds in the neutral posture, 27 pounds at 15 degrees neck flexion, 40 pounds at 30 degrees neck flexion, 49 pounds at 45 degrees neck flexion and 60 pounds at 60 degrees neck flexion, respectively. Therefore, increased neck flexion induced high load on the cervical spine. From this result, smartphone user in neutral head posture is recommended (Figure 12).[41]



Position	Neutral	15°	30°	45°	60°	90°
Force To Cervical Spine	10-12lbs.	27lbs.	40lbs.	49lbs.	60lbs.	Not Measurable

Figure 12 Load on the cervical spine in various neck flexion degrees[41]

Muscle activity increased in high neck flexion posture. Ning et al, 2015 found that using a smartphone in high neck flexion by putting a device on a table showed more EMG of neck extensor when compared with less neck flexion which is in the posture of holding in left hand on chest level in standing posture (Figure 13).[63]

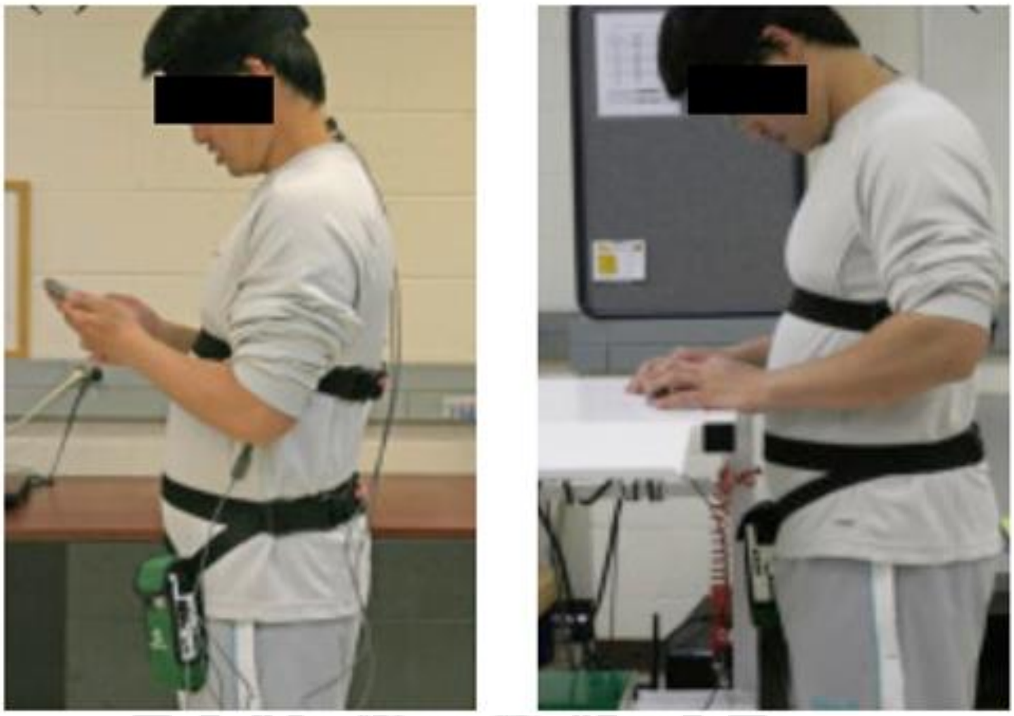


Figure 13 Smartphone using in various neck flexion which holding smartphone on chest level (Left) and putting device on table (Right)[63]

LEE et al, 2015 found most muscle fatigue of upper trapezius muscles in neck flexion at 50 degrees and muscle fatigue of upper trapezius muscles in neck flexion 30 degrees.[64] This is close to the study of Choi et al, 2016, which found most of muscle fatigue of neck and shoulder muscle (splenius capitis and upper trapezius muscles) while using smartphone in maximum neck bending posture when compared with middle neck flexion and neutral posture after smartphone use for 5 minutes. The result shows most of muscle fatigue of neck and shoulder muscles in maximum bending posture when compare with middle bending posture (Figure 14).[29]

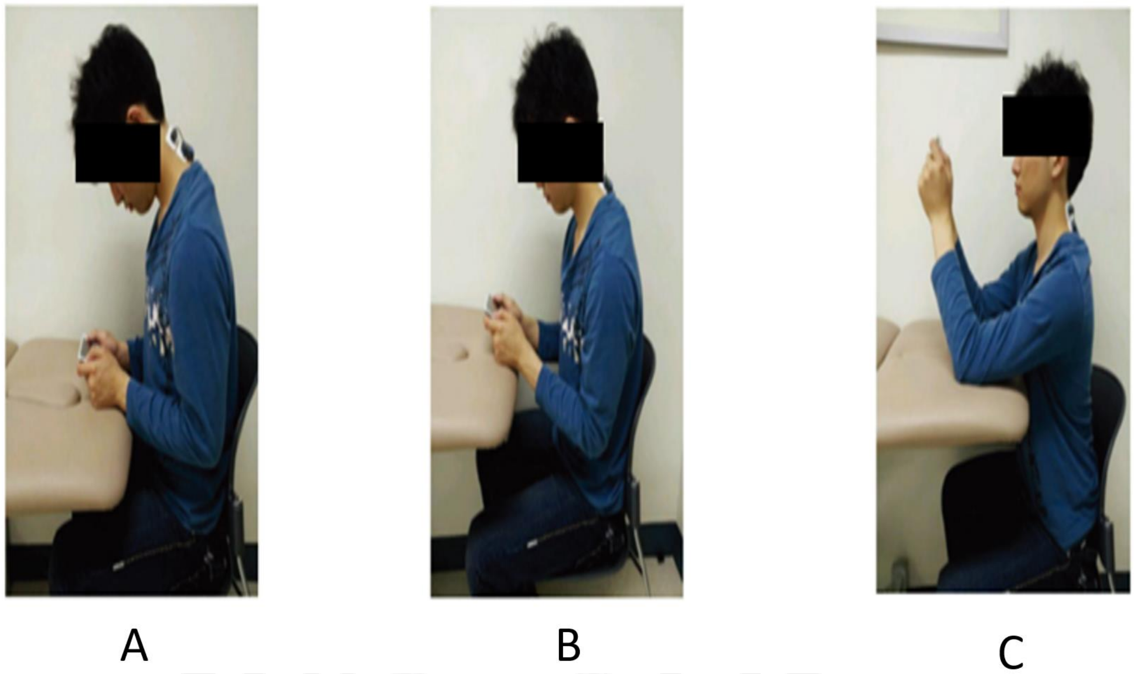


Figure 14 Three postures while using smartphone: (A) Maximum bending posture, (B) Middle bending posture, (C) Neutral posture[29]

Related to Intolo et al, 2016 which studied smartphone use in 3 postures (putting smartphone on the lap, holding smartphone at chest level, and putting smartphone on the table) for 20 minutes. The result showed that muscle activities of cervical erector spinae muscle while using smartphone in putting smartphone on a lap posture had higher EMG of CES (Cervical erector spinae) when compare with others postures.[25] Because placing a smartphone on lap increased the distance between eyes and device so it was difficult to see the text and pictures on the screen, therefore, EMG of cervical erector spinae, upper trapezius and splenius capitis muscles were higher usual.[18, 20, 25, 29, 63] From the literature review, neutral or slight neck flexion while using smartphone is recommended to prevent pain and less muscle activity of neck and shoulder muscles.

5.3 Supporting elbow

Gustafsson et al, 2011 found that texting a message with 300 characters on a mobile phone showed a lesser muscle activity of Trapezius muscles in sitting with elbow support than other postures.[28] Related to Dennerlein et al, 2015 showed that smartphone use in sitting with elbow support decreased neck flexion angle and reduced neck and shoulder pain.[20] Johan et al, 2020 suggested to use an upper limb support for people who use the smartphone frequently. It was found that sitting posture with elbow support, showed less constrains for the joints and Head-Smartphone Distance and neck had less stressed (flexion <10˚) and trunk and shoulder were supported in sitting were suggested (Figure 15).[71]

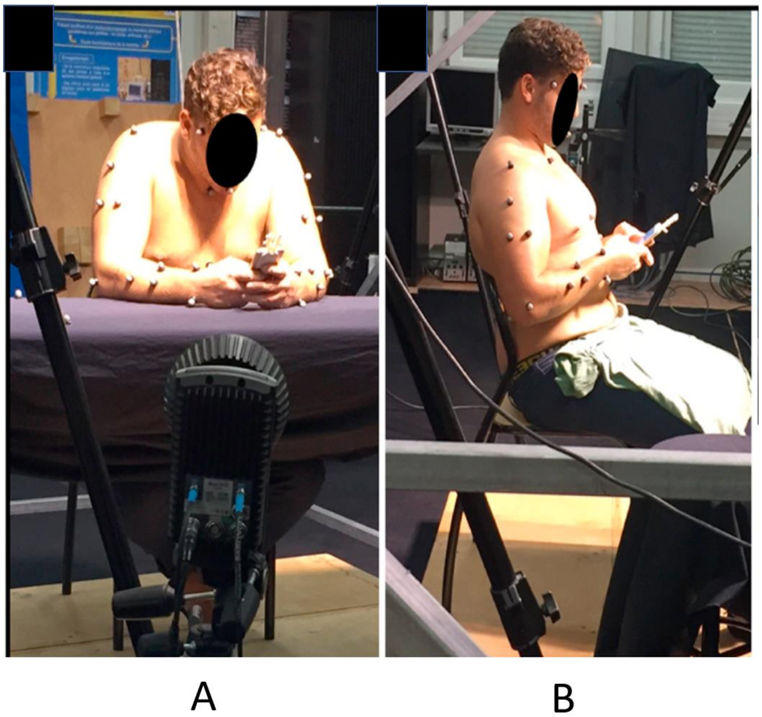


Figure 15 Experimental position: (A) Using smartphone in sitting posture with elbow support, (B) Using smartphone in sitting posture without elbow support [71]

Form a review literature above, it can be seen that supporting elbow during smartphone use showed less pain and EMG. However, pain during smartphone use in this posture in elderly group has not been yet studied.

5.4 Holding smartphone with both hands

Holding smartphone with two hands was recommended in previous studies. Xie et al, 2016 found, that smartphone texting was associated with higher activity in neck extensor compared with computer typing, and bilateral texting was lesser EMG of forearm muscle when compared with one hand texting especially in the both hand.[36] Related to LEE et al, 2015 which found that EMG of upper trapezius, extensor pollicis longus and abductor pollicis while used smartphone with both hands was lesser than holding smartphone with one hand in young adults. The results showed that used smartphone with one hand caused greater upper trapezius pain and induced increased upper extremity muscle activity than used smartphone with both hands.[39] In addition, it is close to the study of LEE et al, 2016 studied in muscle activity of upper trapezius, extensor carpi radialis, and abductor pollicis while smartphone use with both hands had a lesser effect than that of one-hand smartphone use (Figure 16).[37]

Figure 16 Smartphone use during sitting with one-handed use (A) and double handed use (B)[37]

Gustafsson et al, 2011 found that texting a message 300 character on a mobile phone had muscle activity of extensor digitorum while using smartphone with both hands was lower than one hand.(28) In addition, postures (sitting or standing) and the type of mobile phone task (holding the phone versus texting) affected muscle activity and thumb postures.(72) Yoon et al, 2013 found that using a smartphone with one hand (dominant side) and two hands, muscle activity of neck (levator scapulae and middle trapezius), shoulder (infraspinatus and mid deltoid), elbow (biceps, brachioradialis), wrist (flexor and extensor carpi radialis), thumb (extensor and abductor policis, dorsal interossei) with two hands was lower than one hand.(40) Related to the study found, Two-handed hold tended to pose more strain with lower muscle activity on wrists, fingers and thumbs compared to One-handed hold.(38) From this review, smartphone use with both hands is effective in preventing of musculoskeletal disorders.

Accordingly, upright sitting posture, neutral or slight neck flexion, hold smartphone with both hands and supporting elbow helped to reduce pain and risk of musculoskeletal problems in smartphone users in university students and adults.(35) However, there has not been yet studied muscular pain during smartphone use in elderly group in different posture.

Outcome measurement

1. Severity of Pain measurement

Pain outcome measures are commonly used to assess the severity of pain in children, adolescents, and adults. Symptom has been measured by using the visual analog scale (VAS), Wong Baker scale, Numeric rating scale (NRS), verbal rating scale (VRS), and faces pain scale revised.[73] Visual Analog Scale (VAS) and numeric pain scale (NRS) are commonly used in pain evaluation in adults. A systematic review presented that the most instruments used to indicate pain intensity were VAS (52 studies in an overall 54 studies) and NRS (32 studies in an overall 54 studies).[74] Hawker et al, 2011 found that VAS had a high reliability (ICC=0.94,p< 0.001) and high validity. NRS scale also had a high reliability and high validity.[75] It was found that test–retest reliability of the VAS within a short space of time showed 90% of the scores closely together (Figure 17).[76, 77] VAS has more sensitivity for pain than NRS.[74] Alghadir et al, found that VAS had a high reliability (ICC=0.97, p< 0.001) and NRS also had a high reliability (ICC=0.95, p< 0.001).[78] Overall, the VAS was most frequently used scale. A VAS is easy to understand, administer, and score. VAS measures of acute pain are valid and reliable.[79] Laetitia et al, 2008 found that VAS scale has high validity (Pearson correlation; r=0.96,p < 0.001)[80], similarly, Holdgate et al, 2003 showed that VAS scale has high validity (Pearson correlation; r=0.95).[81] VAS typically presented as a horizontal line (10 cm (100 mm) in length), anchored with two verbal descriptors at the extremes where respondents indicate their perceived status by placing a mark along the horizontal line at the most appropriate point (Figure 18).[76, 82] The previous studies also used VAS for measured pain form using smartphone in university students and office workers.[15, 25, 26, 34, 35]

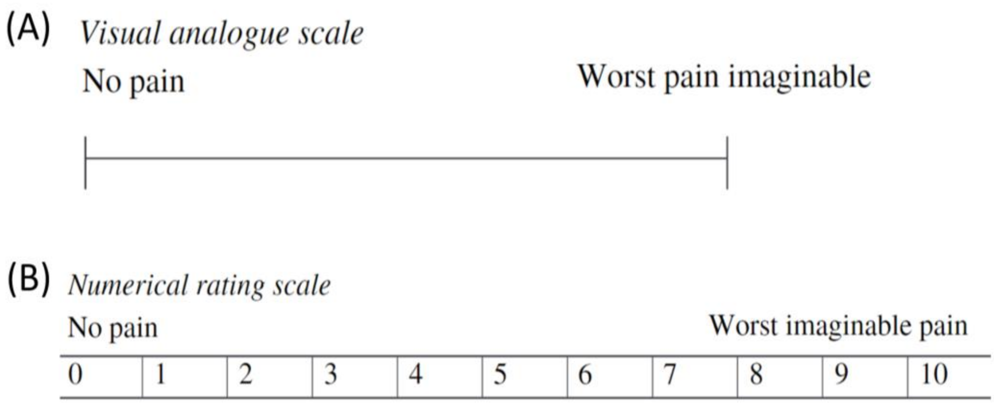


Figure 17 Pain rating scales: (A) Visual analog scale scale (VAS), (B) Numerical rating scale (NRS)[76]

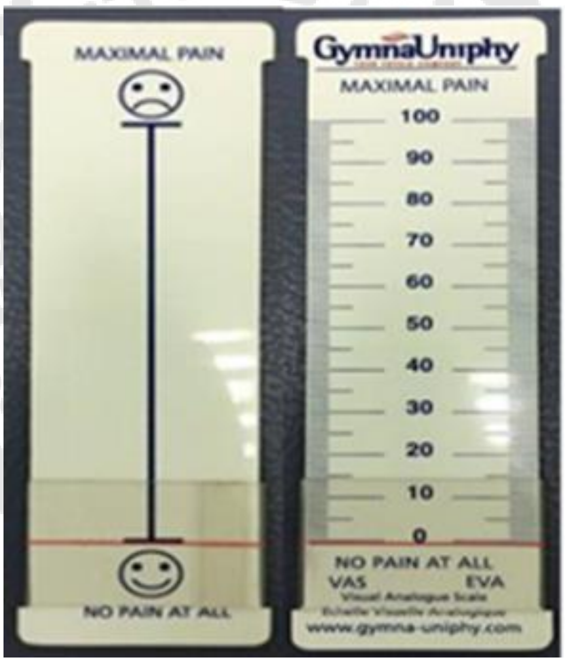


Figure 18 Visual analog scale scale (VAS)[76]

2. Location of pain measurement (Body pain chart)

Body pain chart is another way of measuring pain intensity, is body discomfort chart to improve the specificity in reporting of musculoskeletal symptoms among adult smartphone and tablet device users.[25, 26, 35, 42, 83] Location of pain in body pain chart included areas in body such as neck, shoulder, upper back, lower back, arm, and hands.[17, 42, 83] In a previous study, a body pain chart and hand diagram were used to indicate the location of pain after 20 minutes of smartphone use.[35]

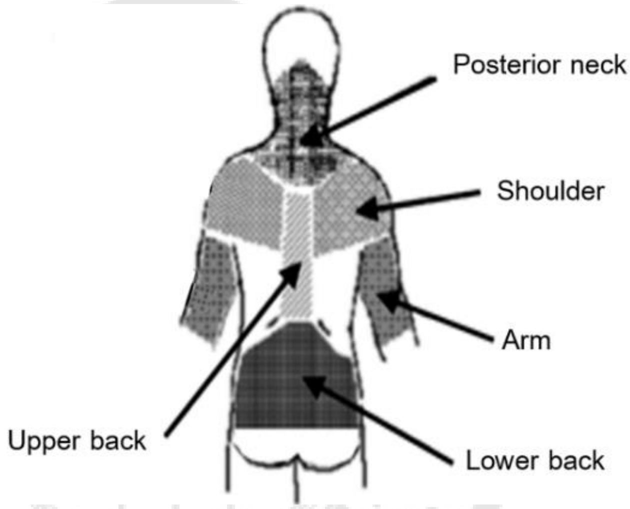


Figure 19 Body pain chart[83]

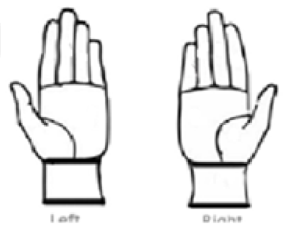


Figure 20 Hand diagram[42]

CHAPTER 3
METHODOLOGY

Research Design

This research is a cross-sectional study design.

Participants

Twenty participants who met the eligibility criteria was recruited into the current study. Inclusion criteria was participant aged range 60-69 years old[6, 13, 14, 44] had smartphone and had experience using a smartphone at least 2 hours a day for at least 2 days a week[84], normal BMI (18.5-22.9 kg/m^2)[85],normal vision (20/20)[86] or corrected to normal with eyeglasses or contact lenses and asymptomatic pain in the neck, shoulders, upper back, lower back, elbow, arm and hands that required regular visits to the doctor or physical therapist within 1 week were included into this study.

Exclusion criteria was participants had pain indications at the time of study or took medication to relieve pain 1 week prior, or had a neurological disease such as a stroke, spinal cord injury, multiple sclerosis, were excluded. In addition, participants with a history of any orthopedic surgery at the shoulder, spine and hip, and spinal scoliosis and had Thoracic hyperkyphosis (Occiput-to-wall distance < 5cm)[87, 88] was also be excluded.

The researcher informed us of the current study in the elderly club in Ongkharak, Nakhon Nayok province, Thailand. The study was approved by the Human Research Ethics Committee of the Faculty of Physical Therapy of Srinakharinwirot University. (PTPT2022-001).

Sample size calculation

The participants in this study were recruited by using a purposive sampling method to have the target population. The sample size was calculated by using a G-power program. The effect size from the similar research design, procedure and same outcome measured was used in this study and will investigate one parameter: severity of pain during the smartphone usage.

Number of sample size of the current study was 6 by using Shin et al, 2014 [89]study as a reference with effect size = 3.3 and 95% confidence interval and investigate parameter is severity of pain after using a smartphone (Figure 21).

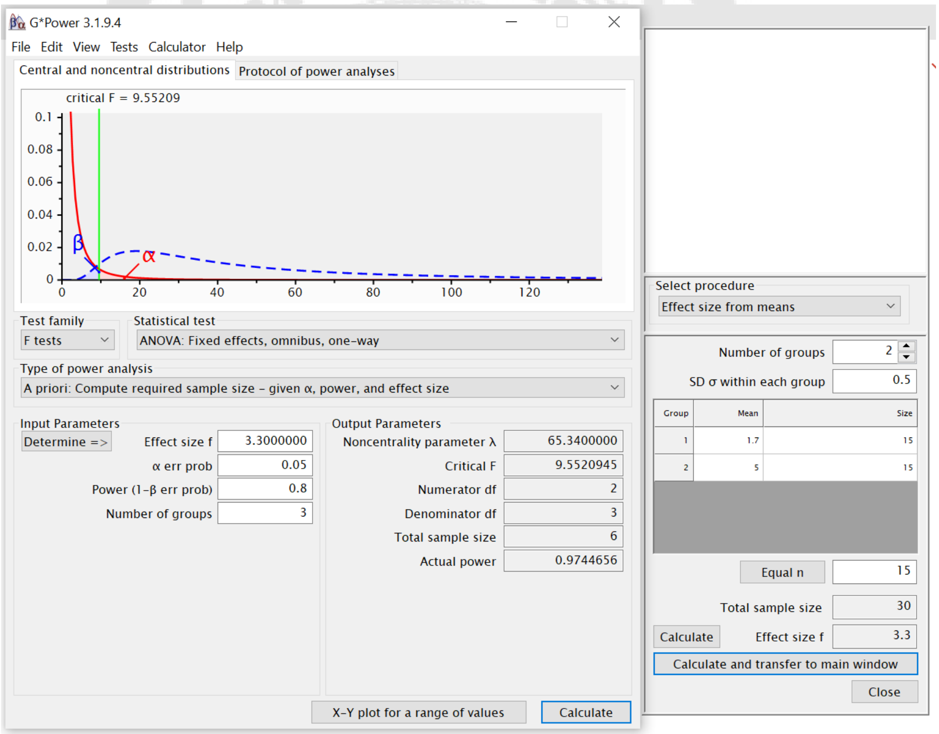


Figure 21 Data of severity of pain between sitting posture in smartphone use was used to calculate Effect size and total sample size.[89]Sample size was 6.

Number of sample size of the current study was 6 by using Intolo et al[34] study as a reference with effect size = 1.35 and 95% confidence interval and investigate parameter is severity of pain after using a smartphone (Figure 22).

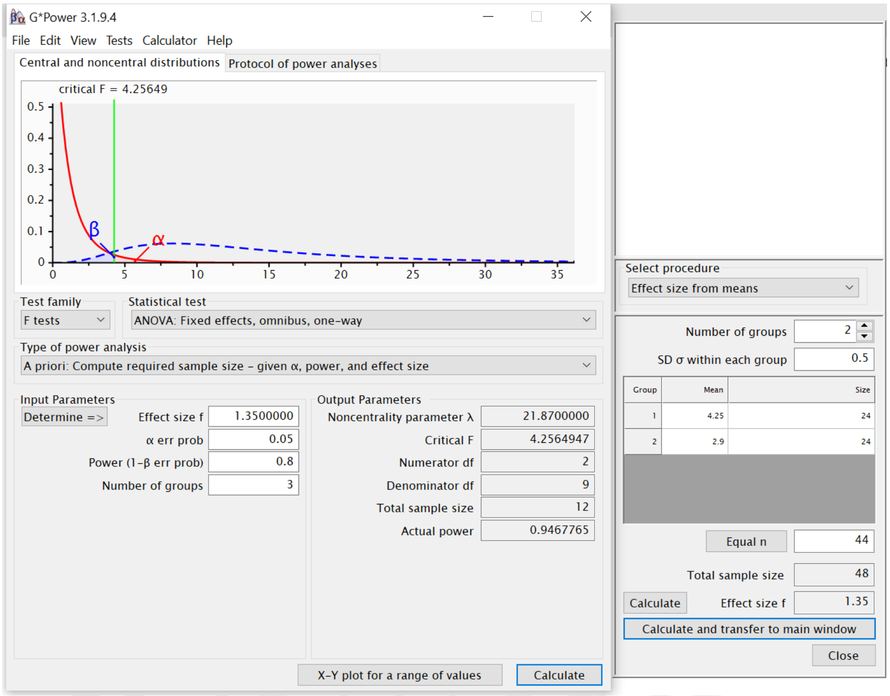


Figure 22 Data of severity of pain between sitting posture in smartphone use was used to calculate Effect size and total sample size.[34] Sample size was 12.

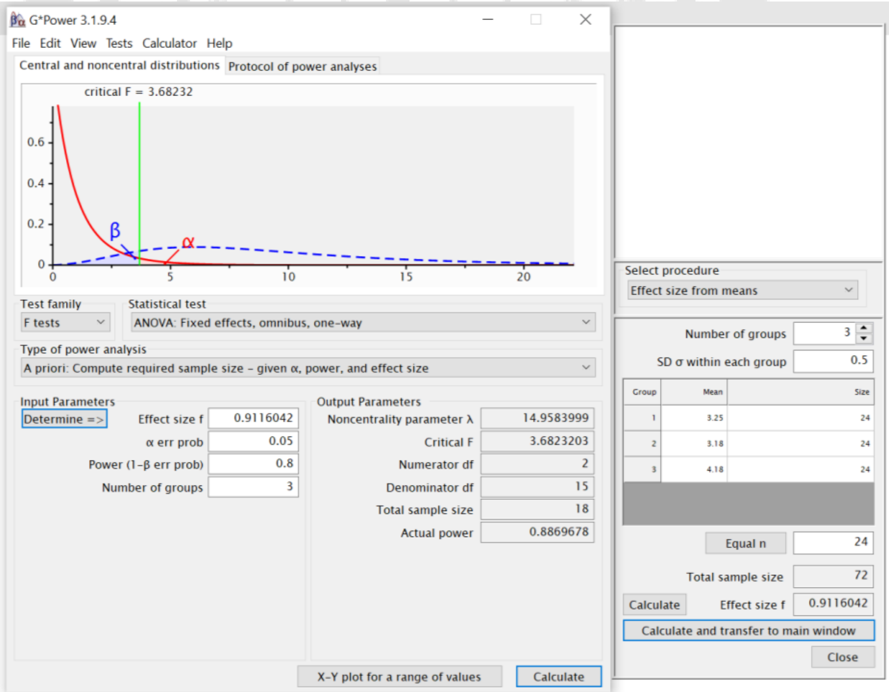


Figure 23 Data of severity of pain between sitting posture in smartphone use was used to calculate Effect size and total sample size.[25] Sample size was 18.

To sum up, the sample size of the current study was 20 by using Intolo et al, 2016 study as a reference with effect size = 0.91 and 95% confidence interval (Figure 23).[25] Therefore, this study was focus on 20 elderly participants. In cases of participant withdrawal or inability to continue the research process for each participant, additional participants were recruited to complete the aiming of sample size of 20.

Setting

Faculty of Physical Therapy, Srinakharinwirot University (Ongkharak), Thailand

Research Instrument

1.Smartphone

2.Visual Analog Scale (VAS)[76, 90]

3. Body pain chart[83] and Hand diagram[42]

4. Chair

Variable of study

Independent variables

Posture during smartphone usage

1) Preferred sitting posture

2) Sitting upright and holding the smartphone with two hands at chest level

3) Sitting upright with elbow support and holding the smartphone with two hands at chest level

Dependent variables

Severity of pain

Number of locations of pain

Procedure

Participants were sign the consent form, measured weight and height for calculating their BMI, recorded hand dominance and screen out the spinal scoliosis by observation. Thoracic hyperkyphosis was screened by occipital-to-wall (OWD) distance technique. For this technique, participants were stand upright as tall as possible with both heels, sacrum and back against the wall. Distance from the bone of C7 to the wall was measured. Occiput-to-wall distance was less than 5 centimeters (Figure 24).(88) Normal vision was screened by Visual acuity chart. Participants who were short sighted or long sighted were corrected to normal vision by wearing their own eyeglasses or contact lenses and read a short message on their smartphone. The researcher was explained how to measure the severity of pain by using VAS and clarify the location of pain measured using a Body pain chart and hand diagram. The task was watching videos on YouTube via the smartphone, which was explained to participants prior.

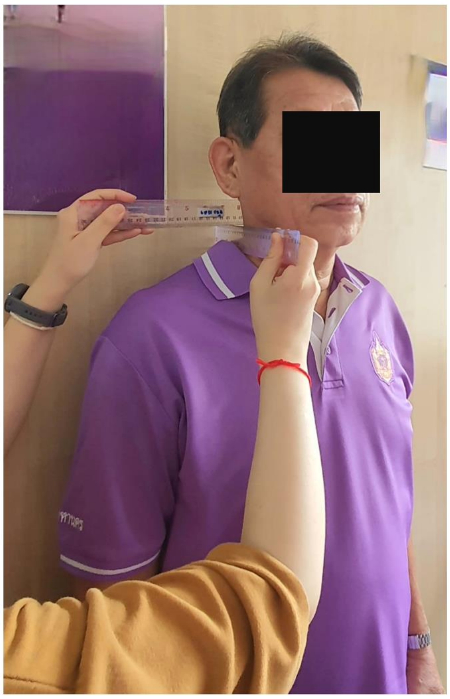


Figure 24 Measurement of Occipital-to-wall distance (OWD)

Order of sitting postures was randomized by using a randomized computer program and explained clearly to the participants. Participants were used a smartphone in random order of three postures (Figure 25) which were

Posture 1: Preferred sitting posture (“preferred sitting”).

Participant used the smartphone in the most comfortable preferred posture to them. The researcher did not correct their posture in this posture. Command was “sitting in preferred posture during the test”.

Posture 2: Sitting upright and holding the smartphone with two hands at chest level (“no elbow support”).

Participants used the smartphone while sitting upright, had neutral or slight neck flexion and hold the smartphone with both hands at chest level. Command was “sit in an upright posture by holding the smartphone at chest level and remind yourself to correct your posture if you relax from this posture”.

Posture 3: Sitting upright with elbow support and holding the smartphone with two hands at chest level (“elbow support”).

Participants used the smartphone while sitting upright , had a neutral or slight neck flexion and hold the smartphone with both hands with two elbows supporting them placed on the pillow. Command was “sit in upright posture by holding smartphone at chest level and remind yourself to correct your posture and hold smartphone at chest level. During this test relax your shoulder and rest your arm on the support. Remind yourself to sit upright if you relax from this posture”.

In all postures, participants sat on a chair with their feet on the floor. A foam sheet was added to the research in participants whose feet were not on the floor. The Angles of hip and knee were flexed 90 degrees. Participants sat in upright posture (anterior pelvic tilt) in both "no elbow support" and "elbow support" conditions.

In “no elbow support” and “elbow support”, the researcher had clarified understanding with participant to remind themselves to sit with the correct posture (sitting upright, neutral or slight neck flexion and holding smartphone at chest level) during using the smartphone for 15 minutes. The researcher was prop warning signs on the wall in front to remind participants of this while using the smartphone. Participants did not rest against a backrest in all postures.

All participants used their own smartphone, so they were familiar with the functions on the screen device. Task chosen for the study was watching a video on YouTube with no texting[6] for 15 minutes. Severity of pain and location of pain was measured immediately after 15 minutes use in each posture. Breaks in between postures was 10 minutes. During break time, participants was rest by lying down on their back, with a pillow placed under their knees and was participate in no further activity for the remainder of the break. After break time for 10 minutes, pain returned to zero, on a scale out of zero to ten. If the participant still displayed signs of pain, they were rest until pain returns to zero before using the smartphone in the next posture. Participants were reported their location of pain and severity of pain immediately after smartphone use for 15 minutes by using a body pain chart, hand diagram and VAS. To prevent long duration of pain rating after smartphone use, the research explained how to indicate severity of pain and location of pain on VAS, body pain chart, and hand diagram. Therefore, participants used a few minutes for rating severity of pain and location of pain.

Data was collected in the same room during the day from 9:00 a.m. to 3:00 p.m. Room temperature, lighting and noise were controlled to maintain a consistency in the environment throughout the study. Room temperature was 25 degrees in this study.

Participants were able to withdraw if they want to leave the study at any time. The researcher was applied any physiotherapy treatment (gentle massage, stretching or cold pack etc.) to relieve any pain. The current study was measured the location of pain in the dominant side and specify pain in the posterior part of body.

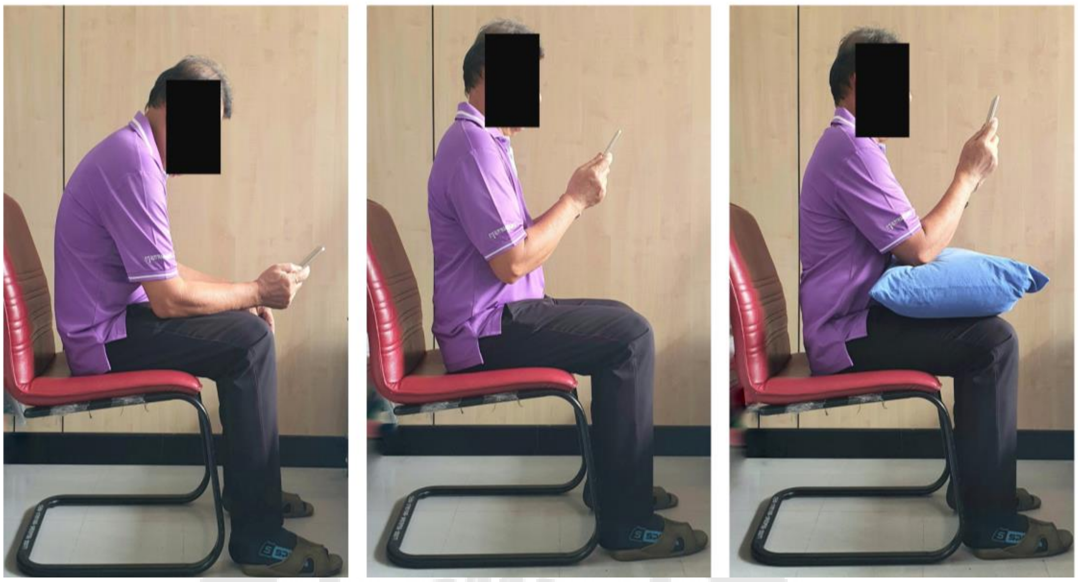


Figure 25 Smartphone usage with three postures (A) “preferred sitting”, (B) “no elbow support”, (C) “elbow support”

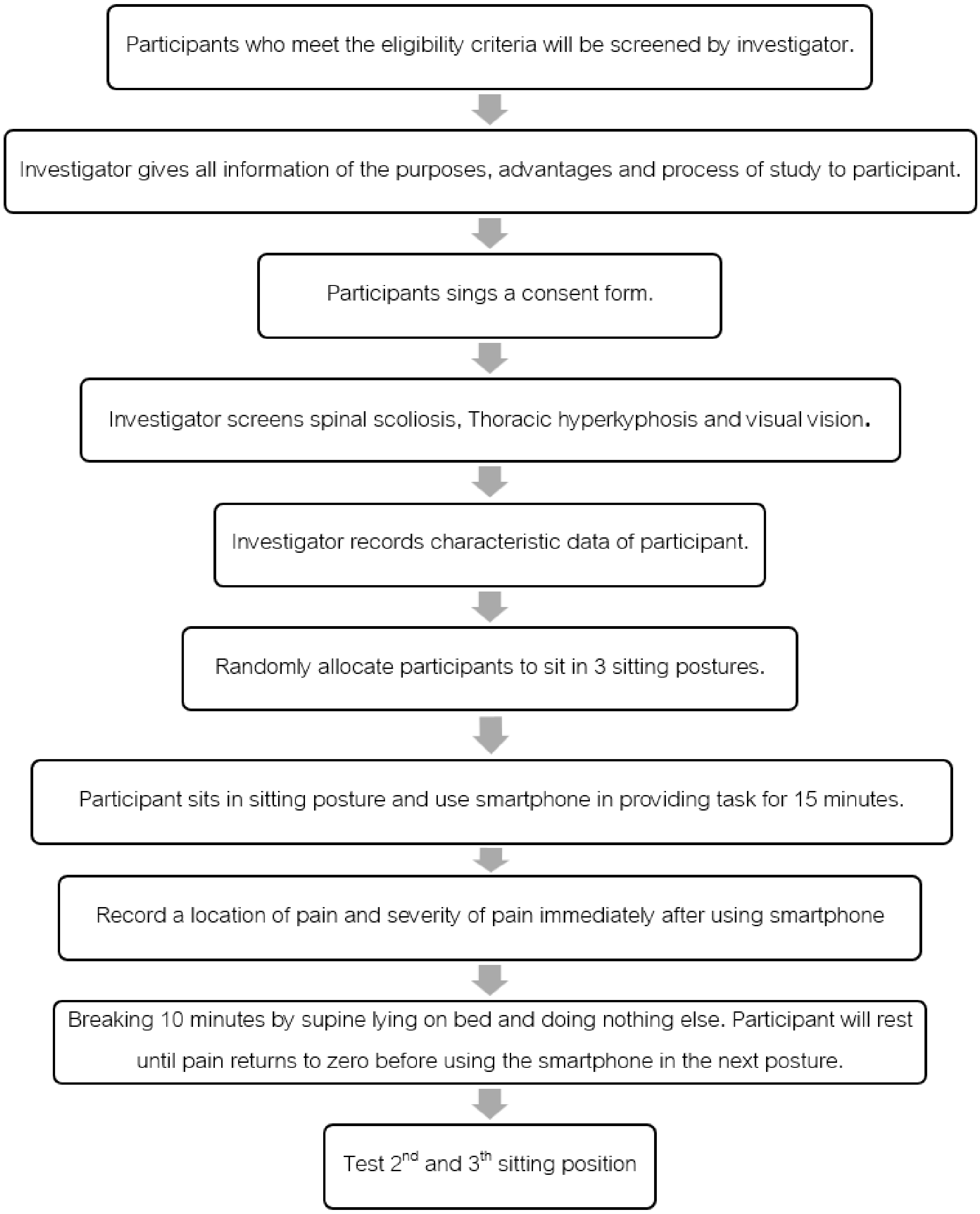


Figure 26 Procedure for this study

Measurement

Participants were indicated a location of pain and a severity of pain in Body pain chart, Hand diagram and Visual Analog Scale (VAS), immediately after smartphone use for 15 minutes (at 15 minutes) in each posture.

Location of Pain measurement

Participants were indicated a location of pain on Body pain chart (Figure 27)[83] and Hand diagram (Figure 28).[42] Pain area was comprising of 7 parts: posterior neck, upper back, lower back, shoulder, arm, wrist, and hand. Participants cloud indicated more than one area of pain. The current study was measured location of pain in the dominant side and specify pain in the posterior part of body. Locations of pain were neck (area beside neck from C1 to C7), upper back (area between midline and medial border of scapular from T1 to T7), lower back (area below scapular to L5), shoulder (area from midline laterally to acromion process), arm (area from arm to wrist), wrist and hand (area from wrist to fingers).[83]

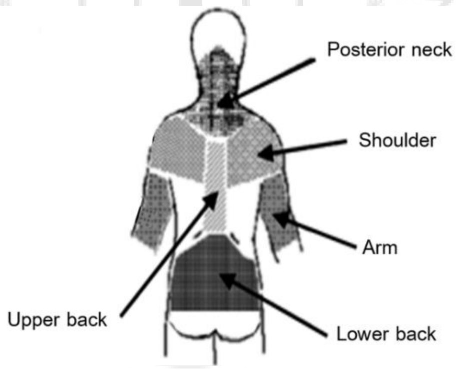


Figure 27 Body pain chart[83]

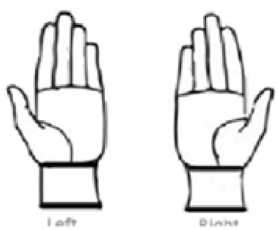


Figure 28 Hand diagram[42]

Pain measurement

Participants were indicated the severity of pain on Visual Analog Scale (VAS) (Figure 29).[76, 90] The front part of VAS shows a vertical line with a transparent bar with no numbers and letters. Participants were moved this bar to indicate their severity of pain. In the back part of VAS was a number indicated the pain level. Severity of pain were divided by the cutting point which were no pain (0-0.4), mild pain (0.5–4.4), moderate pain (4.5–7.4), and severe pain (7.5–10.0).[75]

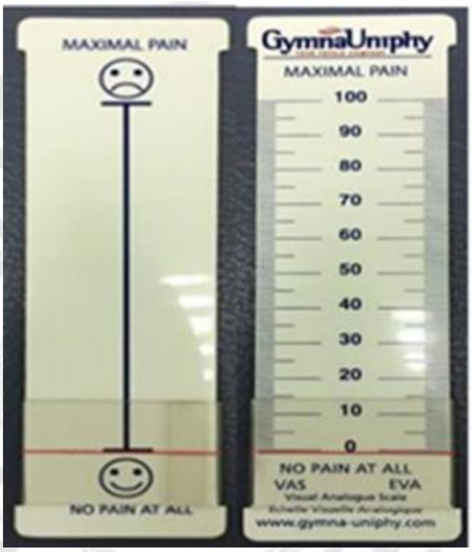


Figure 29 Visual Analog Scale (VAS)[76]

Statistical analysis

The normality of the distribution data of the severity of pain was analyzed by using a Kolmogorov-Smirnov test. It was found that the data was not a normal distribution, so the nonparametric statistical analysis was used. Hypothesis tests comparing severity of pain among three postures were analyzed by using a Kruskal-Wallis test. Comparison of number of locations of pain among three sitting postures were analyzed by using a Kruskal-Wallis test. The number of participants reported pain among three sitting postures were clarified to calculate the mean and standard deviation of the data.

CHAPTER 4

RESULTS

Characteristics of participant

Twenty participants aged among 60-69 years old (3 males and 17 females). Mean and standard deviation of age, height (150-177 cm), weight (45-70 kg) and BMI (45-70 kg/m^2) were 63.70±2.97 years old, 158.00±6.97 cm, 55.50±5.94 kg, 19.20±22.80 kg/m^2.

Comparison of severity of pain among three sitting postures

The overall results showed that neck pain, upper back pain, lower back pain and arm pain in the “preferred sitting” were significantly higher than in the “no elbow support” (p-value < 0.05). Neck pain, shoulder pain, upper back pain, lower back pain in “preferred sitting” were significantly higher than in the “elbow support” (p-value < 0.05). The result showed shoulder pain and arm pain in “no elbow support” were significantly higher than in the “elbow support” (p-value < 0.05). Details were summarized in Table 1.

Neck pain in “preferred sitting” was significantly higher than in the “no elbow support” with p-value of 0.001, with mean and standard deviation of severity of pain of 4.5±1.6 vs 0.3±0.9 (Total score =10). Neck pain in “preferred sitting” was significantly higher than in the “elbow support” with p-value of 0.001, with mean and standard deviation of severity of pain of 4.5±1.6 vs 0.0±0.0. However, there was no significant difference in neck pain between “no elbow support” and “elbow support” (Table 1).

Upper back pain in “preferred sitting” was significantly higher than in the “no elbow support” with p-values of 0.042, with mean and standard deviation of severity of pain of 1.0±1.8 vs 0.0±0.0. Upper back pain in “preferred sitting” was significantly higher than in the “elbow support” with p-value of 0.042, with mean and standard deviation of severity of pain of 1.0±1.8 vs 0.0±0.0. However, there was no significant difference in upper back pain between “no elbow support” and “elbow support” (Table 1).

Lower back pain in “preferred sitting” was significantly higher than in the “no elbow support” with p-value of 0.011, with mean and standard deviation of severity of pain of 1.6±2.2 vs 0.1±0.4. Lower back pain in “preferred sitting” was significantly higher than in the “elbow support” with p-value of 0.012, with mean and standard deviation of severity of pain of 1.6±2.2 vs 0.0±0.0. However, there was no significant difference in lower back pain between “no elbow support” and “elbow support” (Table 1).

Shoulder pain in “preferred sitting” was significantly higher than in the “elbow support” with p-value of 0.001, with mean and standard deviation of severity of pain of 2.7±2.2 vs 0.0±0.0. Shoulder pain in “no elbow support” was significantly higher than in the “elbow support” with p-value of 0.003, with mean and standard deviation of severity of pain of 1.8±1.8 vs 0.0±0.0. However, there was no significant difference in shoulder pain between “preferred sitting” and “no elbow support” (Table 1).

Arm pain in “no elbow support” was significantly higher than in the “elbow support” with p-value of 0.005, with mean and standard deviation of severity of pain of 1.3±1.4 vs 0.0±0.0. And arm pain in “no elbow support” was significantly higher than in the “preferred sitting” with p-value of 0.005, with mean and standard deviation of severity of pain of 1.3±1.4 vs 0.0±0.0. However, there was no significant difference in arm pain between “preferred sitting” and “elbow support” (Table 1).

However, there was no significant difference in wrist and hand pain between “preferred sitting” and “no elbow support”, there was no significant difference in wrist and hand pain between “preferred sitting” and “elbow support” and there was no significant difference in wrist and hand pain between “no elbow support” and “elbow support” (Table 1).

Table 1 Severity of pain at neck, upper back, lower back, shoulder, arm, wrist, and hand in 3 postures

Pain areas	Pain scale (Total score = 10)		
	Preferred sitting	No elbow support	Elbow support
Neck	4.5±1.6[a,b]	0.3±0.9	0.0±0.0
Upper back	1.0±1.8[a,b]	0.0±0.0	0.0±0.0
Lower back	1.6±2.2[a,b]	0.1±0.4	0.0±0.0
Shoulder	2.7±2.2[b]	1.8±1.8[c]	0.0±0.0
Arm	0.0±0.0[a]	1.3±1.4[c]	0.0±0.0
Writs	0.0±0.0	0.0±0.0	0.0±0.0
Hand	0.6±1.4	0.0±0.0	0.0±0.0

* Kruskal-Wallis test, significant difference at 0.05 level

[a] sig dif between “preferred sitting” and “no elbow support”, [b] sig dif between “preferred sitting” and “elbow support”, [c] sig dif between “no elbow support” and “elbow support”

Comparison of the number of locations of pain in 3 sitting postures

In overall areas in 3 postures, the result shows that the number of locations of pain in “preferred sitting” (47 areas) was significantly higher than in “no elbow support” (24 areas) (p- values < 0.005), the number of locations of pain in “preferred sitting” was significantly higher than in “no elbow support” (p- values < 0.005) and the number of locations of pain in “elbow support” was significantly higher than in “elbow support” (0 area) (p- values < 0.005). The participants reported pain after using the smartphone in 3 sitting postures : neck 20 areas, shoulder 24 areas, upper back 5 areas, lower back 9 areas, arm 10 areas, hand 3 areas. Details were summarized in Table 2.

The number of pains at the neck area in “preferred sitting” (18 areas) was significantly higher than in “no elbow support” (2 areas) with p-values 0.001. The number of pains at the neck area in “preferred sitting” (18 areas) was significantly higher than in “elbow support” (0 area) with p-values 0.001. However, there was no significant difference between “no elbow support” (2 areas) and “elbow support” (0 area) (Table 2).

The number of pains at the upper back area in “preferred sitting” (5 areas) was significantly higher than in “no elbow support” (0 area) with p-values 0.025. The number of pains at the upper back area in “preferred sitting” (5 areas) was significantly higher than in “elbow support” (0 area) with p-values 0.025. However, there was no significant difference between “no elbow support” (0 area) and “elbow support” (0 area) (Table 2).

The number of pains at lower back area in “preferred sitting” (8 areas) was significantly higher than in “no elbow support” (1 area) with p-values 0.008. The number of pains at lower back area in “preferred sitting” (8 areas) was significantly higher than in “elbow support” (0 area) with p-values 0.005. However, there was no significant difference between “no elbow support” (1 area) and “elbow support” (0 area) (Table 2).

The number of pains at shoulder area in “preferred sitting” (13 areas) was significantly higher than in “ elbow support” (0 area) with p-values 0.001. The number of pains at shoulder area in “no elbow support” (11 areas) was significantly higher than in “elbow support” (0 area) with p-values 0.002. However, there was no significant difference between “preferred sitting” (13 areas) and “no elbow support” (11 areas) (Table 2).

The number of pains at arm area in “no elbow support” (10 areas) was significantly higher than in “preferred sitting” (0 area) with p-values 0.002. The number of pains at arm area in “no elbow support” (10 areas) was significantly higher than in “elbow support” (0 area) with p-values 0.002. However, there was no significant difference between “preferred sitting” (0 area) and “elbow support” (0 area) (Table 2).

However, there was no significant difference at wrist and hand area in “preferred sitting” between “no elbow support” (p-values < 0.005). There was no significant difference at wrist and hand areas in “preferred sitting” between “elbow support” and there was also no significant difference in “no elbow support” and “elbow support” (Table 2).

Table 2 The number of locations of pain during smartphone use in 3 postures

Pain areas	Number of locations of pain in 3 postures (areas)		
	Preferred sitting	No elbow support	Elbow support
Neck	18[a,b]	2	0
Upper back	5[a,b]	0	0
Lower back	8[a,b]	1	0
Shoulder	13[b]	11[c]	0
Arm	0[a]	10[c]	0
Writs	0	0	0
Hand	3	0	0
Overall areas	47[a,b]	24[c]	0

* Kruskal-Wallis test, significant difference at 0.05 level

[a] sig dif between “preferred sitting” and “no elbow support”, [b] sig dif between “preferred sitting” and “elbow support”, [c] sig dif between “no elbow support” and “elbow support”

Comparison number of participants reported pain during smartphone use in 3 postures

The severity of pain was measured by VAS and divided into 4 levels which were no pain (0-0.4), mild pain (0.5-4.4), moderate pain (4.5-7.4) and severe pain (7.5-10) (Total score =10).[75] In "preferred sitting", participants reported pain at neck 18 areas (mild pain =7 participants, moderate pain = 11 participants), shoulder 13 areas (mild pain = 9 participants, moderate pain = 4 participants), upper back 5 areas (mild pain = 3 participants, moderate pain = 2 participants), lower back 8 areas (mild pain = 6 participants, moderate pain = 2 participants), hand 3 areas (mild pain = 3 participants) and no pain at wrist. In "no elbow support", participants reported mild pain at neck 2 participants, shoulder 11 participants, lower back 1 participant, arm 10 participants and no pain at upper back and wrist. All participants who used smartphones in "elbow support" reported no pain in all areas. Details were summarized in Table 3.

These results showed that participants reported pain after smartphone use for 15 minutes in "preferred sitting" were higher than "no elbow support" and "elbow support". Not only the number of pain areas were highest in 3 postures, but the severity of pain also was highest in 3 postures. Meanwhile, participants reported the number of pain areas in "no elbow support" was higher than "elbow support" but the pain level was mild. However, the result showed that there was no severe pain after smartphone use in elderly in 3 sitting postures.

Table 3 Number of participants reported pain during smartphone use in 3 postures

Pain scale (0-10.0)[75]	Pain areas (N = 20) Number of participants reported pain (per cent)					
	Preferred sitting		No elbow support		Elbow support	
No pain (0 – 0.4)	Neck	2(10%)	Neck	18(90%)	Neck	20(100%)
	Upper back	15(75%)	Upper back	20(100%)	Upper back	20(100%)
	Lower back	12(60%)	Lower back	19(95%)	Lower back	20(100%)
	Shoulder	7(35%)	Shoulder	9(45%)	Shoulder	20(100%)
	Arm	20(100%)	Arm	10(50%)	Arm	20(100%)
	Wrist	20(100%)	Wrist	20(100%)	Wrist	20(100%)
	Hand	17(85%)	Hand	20(100%)	Hand	20(100%)
Mild pain (0.5 – 4.4)	Neck	7(35%)	Neck	2(10%)	Neck	0(0%)
	Upper back	3(15%)	Upper back	0(0%)	Upper back	0(0%)
	Lower back	6(30%)	Lower back	1(5%)	Lower back	0(0%)
	Shoulder	9(45%)	Shoulder	11(55%)	Shoulder	0(0%)
	Arm	0(0%)	Arm	10(50%)	Arm	0(0%)
	Wrist	0(0%)	Wrist	0(0%)	Wrist	0(0%)
	Hand	3(15%)	Hand	0(0%)	Hand	0(0%)
Moderate pain (4.5 –7.4)	Neck	11(55%)	Neck	0(0%)	Neck	0(0%)
	Upper back	2(10%)	Upper back	0(0%)	Upper back	0(0%)
	Lower back	2(10%)	Lower back	0(0%)	Lower back	0(0%)
	Shoulder	4(20%)	Shoulder	0(0%)	Shoulder	0(0%)
	Arm	0(0%)	Arm	0(0%)	Arm	0(0%)
	Wrist	0(0%)	Wrist	0(0%)	Wrist	0(0%)
	Hand	0(0%)	Hand	0(0%)	Hand	0(0%)
Severe pain (7.5 – 10.0)	Neck	0(0%)	Neck	0(0%)	Neck	0(0%)
	Upper back	0(0%)	Upper back	0(0%)	Upper back	0(0%)
	Lower back	0(0%)	Lower back	0(0%)	Lower back	0(0%)
	Shoulder	0(0%)	Shoulder	0(0%)	Shoulder	0(0%)
	Arm	0(0%)	Arm	0(0%)	Arm	0(0%)
	Wrist	0(0%)	Wrist	0(0%)	Wrist	0(0%)
	Hand	0(0%)	Hand	0(0%)	Hand	0(0%)

*A total participant reported pain during smartphone use in 3 sitting postures: Neck 20 areas, Shoulder 24 areas, Upper back 5 areas, lower back 9 areas, arm 10 areas, hand 3 areas.

CHAPTER 5
DISCUSSION AND CONCLUSION

Severity of pain among three sitting postures

This study focuses on pain evaluation in the elderly group during smartphone use due to a lack of evidence of pain evaluation. Previous studies evaluated pain in the elderly, however it was in self-assessment of pain and in long durations, such as a week or a month in survey study. There is currently no study examining immediate pain in the experimental room after smartphone use in elderly individuals. The evidence of this study will be useful in developing a guideline for elderly people in order to prevent the risk of musculoskeletal pain caused by smartphone use.

Overall results showed that pain in “preferred sitting” was the highest when compared with “no elbow support” and “elbow support”. In addition, the result clearly showed that pain in “preferred sitting” was found at neck, upper back, shoulder, and arm areas in elderly groups after smartphone use for 15 minutes.

Neck pain in “preferred sitting” was significantly higher than in the “no elbow support” after smartphone use for 15 minutes in elderly. Related to Intolo et al, 2022[34] which found that neck pain in preferred sitting posture was higher than upright sitting posture in university student groups. Also, related to the study of Intolo et al, 2018[26] which found that after smartphone use for 20 minutes, neck pain increased significantly in placing smartphone on lap posture compared with putting the smartphone at chest level in elementary school students aged 10-12 years old and office worker groups aged 26-40 years old. This finding can be explained due to the fact that “preferred sitting” is typically in a slouched posture, with the smartphone on their lap, leading to high neck flexion which enables them to see the screen clearly. Choi et al, 2016 found that fatigue of neck and shoulder muscles while using the smartphone in high neck bending posture was highest when compared with middle neck flexion and neutral neck posture.[29]

In addition, Hansraj, 2014 found the head and neck forward tilting angle increased the load on the cervical spine from 27 pounds at 15 degrees to 60 pounds at 60 degrees neck flexion.[41] Holding the smartphone at chest level ("no elbow support") showed lesser pain when compared with "preferred sitting". It can be explained that while holding the smartphone at chest level, the device is not far from the eyes, so elderly individuals with compromised eyesight see information on the screen more clearly so it can reduce neck flexion. A previous study found that an adequate distance from the eyes to the smartphone was between 30-40 centimeters.[91] Furthermore, the results of this study showed that neck pain in "no elbow support" and "elbow support" proved lesser when compared with the "preferred sitting" because in these two postures, the elderly individuals were reminded to correct their spinal posture to be in sitting upright, correcting the spinal alignment of pelvic lumbar, with the thoracic and cervical to be in a neutral posture which brings less load on the spine.

Shoulder pain in "preferred sitting" was significantly higher than in the "elbow support" which is related to Dennerlein et al, 2015 which found that smartphone use in sitting with elbow support showed lesser shoulder pain and neck pain caused by less neck flexion.[20] In the "elbow support" posture, participants sat in an upright posture and elbows were supported with a pillow, so the shoulders and arms were relaxed completely with no shoulder elevation. In addition, neck muscles and shoulder muscles did not contract in this posture. Johan et al, 2020 recommended that during smartphone use, arms should be supported. They found that placing arms on the table shortened head-smartphone distance which led to less constraints for the joints because the trunk and shoulder were supported, and the neck flexed less than 10 degrees.[71] In addition, neck flexion in "preferred sitting" was high, therefore neck extensor muscles, which are placed from base of skull to shoulder, worked very hard. In addition, participants would fail to remember to elevate their shoulders. These poor postural conditions led to shoulder pain. Meanwhile, the result of this study showed that shoulder pain in "elbow support" was lesser than "no elbow support". This finding is related to Intolo et al, 2016[35] who found shoulder pain with two elbows supported on a pillow was significantly lesser than sitting with one elbow supported. Pain level of this study in "no elbow support" in elderly group (1.8 out of 10) was close to that of Intolo et al, 2022[34] which was 2.2 out of ten in sitting in an upright sitting posture and holding a smartphone at chest level in university students. The similarities of both studies are most likely due to the fact that they both evaluated the same posture. Even though different age groups were evaluated, the smartphone was held at the same level (chest), therefore neck flexion is reduced, and participants can relax their shoulders in this posture.

Arm pain in "no elbow support" was significantly higher than in the "elbow support". It can be explained that in "elbow support", participants placed their arms on the pillow and did not hold the smartphone at chest level. In the "no elbow support" posture, participants tried to raise their arms to hold the smartphone at chest level. Interestingly, arm pain in "preferred sitting" was 0 out of 10. This is mostly due to participants sitting in slouched posture and placing the smartphone on their lap, resulting in no flexion of the elbow in order to hold the smartphone device. Therefore, arm pain became zero, but was still detrimental to the neck, upper back and lower back posture. The findings of this study conveyed that arm pain scored in the elderly group in "no elbow support" was 1.3 out of 10, which is related to the arm pain score in office workers holding smartphones at chest level, which was reported as 1.2 out of 10 in the study of Intolo, 2018.[26] Clearly, from these results, arm pain in elderly groups and office workers did not differ. It can be explained that the duration of smartphone use is in the same range, between 15-20 minutes.

Upper back and lower back pain in "preferred sitting" was significantly higher than in the "no elbow support" in elderly group. Because sitting in the upright posture in "no elbow support" and "elbow support" decreased flexion of thoracic and lumbar, therefore spinal alignment and curvature are normal. It was found that back muscle activity was low in sitting upright posture.[67, 68] In addition, Edmondston et al, in 2011 found that an upright sitting posture has less load on the lumbar region, thorax, and cervical spine when compared with slouched posture in "preferred sitting".[68] In this study, participants clearly showed that they were sitting in a slouched posture which led to forward head posture, upper back kyphosis and lower back hyperlordosis in "preferred sitting".[37, 64] The finding of this study in elderly group, upper back pain was 1.0 out of 10 which is slightly higher than in university students, which found that upper back pain was 0 out of 10.[35] It can be explained that the curvature decreased at advanced ages, especially in persons aged 50-70 years old. Cervical lordosis and thoracic kyphosis were observed clearly with increasing age.[56] Therefore, when the elderly group in this study tried to sit upright, pain increased to 1 out of 10 which showed the statistical significance, however, it was not clinically significant; Hawker et al, 2011 mentioned that pain level increase or decrease by 2 points out of 10 points was clinically significant.[75]

Wrist and hand pain did not show any significant difference between "preferred sitting", "no elbow support", and "elbow support". It can be explained that in three postures, participants held a smartphone with both hands. Therefore, there was no overload on one particular hand. Related to Xie et al, 2016 and Lee et al, 2015 study, they had found muscle activity in the hand, which were extensor carpi radialis and extensor pollicis longus, and abductor pollicis muscles was lesser than that of one-hand smartphone use.[36, 39]

The number of locations of pain in 3 sitting postures

The results showed that, overall, the number of locations of pain in “preferred sitting” showed the highest number of locations of pain when compared with the “no elbow support” and “elbow support” postures. Moreover, the number of locations of pain at neck, upper back, lower back, and shoulder areas in “preferred sitting” was recorded at the highest when compared with “no elbow support” and “elbow support”. It can be explained that in “no elbow support” and “elbow support”, participants used the smartphone in upright sitting posture with neck in neutral posture and holding the smartphone at chest level, therefore in upright sitting posture, spine was in normal curvature which led to low muscle activity and less load on the cervical, thoracic and lumbar spine. In contrast, in “preferred sitting” almost all participants used the smartphone in a slouch posture which brought poor alignment of the spine (increased neck, thoracic and lumbar flexion) which led to increased muscle activity and increased load on the spine. According to Intolo et al, 2016(35), the number of locations of neck pain was low in “elbow support” posture with 5 areas in neck area and 0 area at upper back (out of smartphone use 90 times) in participants aged 18-25 years old. And close to Intolo et al, 2022(34) which found that the number of locations of neck pain was 17 areas out of smartphone use 88 times, in participants who used smartphones while sitting upright and holding a smartphone at chest level without support.

Interestingly, the number of locations of pain in “no elbow support” was significantly higher than “in elbow support”. It can be explained that in both postures, participants were in sitting upright posture which is good neutral alignment in the spine; however, in “no elbow support” participants had to hold the smartphone at chest level for 15 minutes which led to higher pain at shoulder and arm areas due to the higher muscle activity of shoulders and arms. Related to the study of Intolo et al, 2022(34) which found that the electromyography (EMG) of upper trapezius was about 4% of MVC, in “no elbow support” whereas in the study of Intolo et al, 2016(35) which found that EMG of upper trapezius was about 2.1% of MVC in “elbow support” posture, therefore, it clearly shows that “elbow support” posture reduces muscle activity of upper trapezius which lead to less pain at shoulder.

The results of this study showed that the number of locations of arm pain in “no elbow support” was significantly higher than that of “preferred sitting” and in “ elbow support”. It can be explained that in “no elbow support”, participants kept their arm to hold the smartphone at chest level for 15 minutes without any support at the elbow, therefore it led to pain in the arm area. Conversely, in “preferred sitting” participants placed smartphones on their lap with no working of arm muscles to hold the smartphone. In addition, in “elbow support”, participants placed and relaxed their arms on a pillow. So, in “preferred sitting” and “elbow support”, participants did not raise both arms to hold the smartphone. Close to Intolo et al, 2016[25] which found that the number of locations of pain at arm was 0 areas and 4 areas (from using the smartphone 72 times) on the lap posture and on chest level posture after using the smartphone for 20 minutes in participants aged 18-25 years.

Number of participants reported pain during smartphone use in 3 postures

Results of this study clearly showed that the number of participants reported pain in “preferred sitting” was the highest when compared with the “no elbow support” and “elbow support”. Furthermore, it is apparent that in "preferred sitting" almost all participants reported mild to moderate pain, particularly at all areas, which were neck, upper back, lower back, shoulder and hand areas. But on the other hand, in "no elbow support", participants reported no pain to mild pain at some areas which were neck, lower back, shoulder and hand. Interestingly, in "elbow support" all participants reported no pain in all areas. It can be explained that participants in "elbow support" used smartphones in an upright sitting posture so the pelvic, lumbar, thorax, and neck regions are in neutral postures, which led to less load on the spine.(67, 68) In addition, holding a smartphone at chest level with elbow support reduces muscle activity at shoulder and hands. Whereas, on the other hand, in “preferred sitting”, participants used the smartphone in slouched posture which has a poor alignment of the spine. This finding is related to a previous study which found that participants using smartphones in slouched posture reported overall higher pain than in sitting upright postures.(34) In addition, it is related to a previous study which showed that participants aged between 18-25 years old using smartphones in sitting upright postures with elbow support reported no pain to mild pain in all areas.(35) Similar to this study, participants aged between 60-69 years old who used smartphones in sitting upright posture with or without elbow support were reported no pain to mild pain in all pain areas.

This study discovered that different sitting postures had an effect on the severity of pain, the number of pain locations, and the number of participants who reported pain in the elderly group. And the findings of this study clearly showed that "preferred sitting" had the highest severity of pain and the most pain locations when compared to the other two postures because participants used their smartphones in a slouch posture with poor spine alignment.[25, 26, 29, 37, 64] Participants in the "no elbow support" and "elbow support" groups sat upright with good spinal alignment, resulting in less pain.[27, 66-68, 70] Although pain in the "no elbow support" group increased marginally to 1 out of 10 at the neck, lower back, shoulder, and arm areas when compared to the "elbow support" group, which showed no pain in all areas, there were statistically significant but no clinically significant differences. As a result, "no elbow support" caused less pain than "preferred sitting," while "elbow support" was the best posture for preventing pain from smartphone use in the elderly group.

According to the literature review, supporting the elbow while using a smartphone reduced pain in university students.[35] The pillow was used to support the elbows of participants who were tall, but the pillow was used to support the elbows to the end of the forearm of participants who were shorter. However, the results of this study also revealed that elbow support was beneficial in reducing pain in the shoulder and arm areas while using a smartphone in the elderly group.

The findings of this study revealed that sitting upright in "no elbow support" and "elbow support" postures caused less pain after using a smartphone than "preferred sitting." Participants in the "no elbow support" and "elbow support" conditions sat upright on a chair with their feet on the floor. In this posture, having knees flexed at 90 degrees, prevented more pressure on the popliteal fossa. In addition, hips flexed at 90 degrees prevented a posterior pelvic tilt. Therefore, it led to anterior pelvic tilting and increased lumbar flexion, and upright posture that led to spinal curvature were normal and placed less load on the lumber, thorax, and cervical spine.[27, 66-68, 70]

This study had no issues with pain measurement in the elderly because the researcher had already explained how to measure the severity of pain using VAS where all participants understood clearly how to indicate their pain using VAS and clarify the location of pain measured using the body pain chart and hand diagram prior to data collection. So, in this study, pain was measured approximately a few minutes after using the smartphone for 15 minutes. Therefore, explanations of rating of severity and location of pain prior to data collection in order to avoid mistakes saved time during data collection.

The limitation of this study is that elderly group use a smartphone to watch videos only, however in their daily life, they use it to communicate with family who they will text. There is some possibility that tasks on the smartphone are quite different from the usual. Therefore, in future studies, elderly groups should use smartphones to do a variety of tasks and increase duration of smartphone use.

Clinical Implication

The results of this study clearly showed elderly had muscle pain after using a smartphone for 15 minutes in a preferred sitting posture. However, the results also showed that smartphone use in sitting upright posture without elbow support were less pain level than in preferred sitting posture and smartphone use in sitting upright posture with elbow support were no pain in all areas. That means using a smartphone in sitting upright posture with or without elbow support is better than in preferred sitting posture. For this reason, the researcher was recommended to use a smartphone in sitting upright posture with or without elbow support to prevent the risk of musculoskeletal disorders because of smartphone use in elderly.

Conclusion

After smartphone usage for 15 minutes in elderly groups aged 60-69 years old in 3 sitting postures, this study found that pain at neck, shoulder, upper back, and lower back areas in “preferred sitting” was significantly higher than in two other postures. Pain at shoulder and arm areas in “no elbow support” was significantly higher than in “elbow support”. There was no pain in all areas in “elbow support”. The most painful areas were the neck and shoulder regions. Therefore, the researcher recommends elderly groups use a smartphone in sitting upright posture with elbow support to prevent musculoskeletal pain caused by smartphone use.

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Appendix

Appendix A THE CERTIFICATE OF ETHICAL APPROVAL

เอกสารรับรองโครงการวิจัย
โดยคณะกรรมการจริยธรรมในมนุษย์
คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ

เอกสารรับรองเลขที่	PTPT2022-001
ชื่อโครงการ :	การวิเคราะห์อาการปวดขณะใช้งานสมาร์ทโฟนในท่านั่งในผู้สูงอายุ
ชื่อหัวหน้าโครงการ :	นางสาวภิญญา ภูปภัสศิริ
หน่วยงานที่สังกัด :	สาขากายภาพบำบัด
เอกสารที่รับรอง :	1. แบบเสนอโครงการวิจัย
	2. เอกสารชี้แจงผู้เข้าร่วมการวิจัย
	3. หนังสือยินยอมตนให้ทำการวิจัย
	4. แบบการเก็บรวบรวมข้อมูล/โปรแกรมหรือกิจกรรม
วันที่รับรอง :	**8 กุมภาพันธ์ 2565**
วันที่หมดอายุ :	**7 กุมภาพันธ์ 2566**

ขอรับรองว่าโครงการดังกล่าวข้างต้นได้ผ่านการพิจารณาเห็นชอบโดยสอดคล้องกับคำประกาศเฮลซิงกิ จากคณะกรรมการจริยธรรมในมนุษย์ คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ **ออกให้ ณ วันที่...17...กุมภาพันธ์ 2565**

ลงนาม.......................................
(ผู้ช่วยศาสตราจารย์ ดร.ชัชฎา ชินกุลประเสริฐ)
ประธานคณะกรรมการจริยธรรมในมนุษย์

Appendix B CERTIFICATION OF “THE 4TH NATIONAL CONFERENCE ON SCIENCE, TECHNOLOGY AND INNOVATION 2022”

NCST 2022
Loei Rajabhat University

คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏเลย

ขอมอบเกียรติบัตรฉบับนี้ให้ไว้เพื่อแสดงว่า

ภิญญา ภูปภัสศิริ และ ภัทริยา อินทร์โท่โล่

ได้รับ "รางวัลดี" การนำเสนอผลงานวิจัยระดับชาติ ประเภทบรรยาย "กลุ่มวิทยาศาสตร์สุขภาพ"

เรื่อง การวิเคราะห์อาการปวดขณะใช้งานสมาร์ทโฟนในท่านั่งในผู้สูงอายุ

ในการประชุมวิชาการระดับชาติ ด้านวิทยาศาสตร์ เทคโนโลยี และนวัตกรรม ครั้งที่ 4 ประจำปี 2565

4th National Conference in Science, Technology and Innovation 2022

"วิทยาศาสตร์และเทคโนโลยี สร้างสรรค์นวัตกรรมเพื่อชุมชน"

ให้ไว้ ณ วันที่ 8 เมษายน พ.ศ. 2565

ผู้ช่วยศาสตราจารย์จารุวัลย์ รักษ์มณี
คณบดีคณะวิทยาศาสตร์และเทคโนโลยี

รองศาสตราจารย์สมเจตน์ ดวงพิทักษ์
อธิการบดีมหาวิทยาลัยราชภัฏเลย

Appendix C CONCRETE BENEFITS SHOWN IN RESEARCH RESULTS

เอกสารรับรอง การนำผลงานวิจัยไปใช้ประโยชน์อย่างเป็นรูปธรรม

คำชี้แจง : เอกสารชุดนี้มีวัตถุประสงค์เพื่อประเมินคุณภาพผลงานวิจัยของนิสิตระดับบัณฑิตศึกษา มหาวิทยาลัยศรีนครินทรวิโรฒ ที่สามารถนำไปใช้ประโยชน์อย่างเป็นรูปธรรม

ชื่อ-นามสกุล ม.ล. ปรางพร เชื้อบุญธรณ์

ตำแหน่ง นักกายภาพบำบัดชำนาญการพิเศษ

ชื่อบริษัท/องค์กร โรงพยาบาลกลาง กรุงเทพมหานคร

ได้ใช้ประโยชน์จากปริญญานิพนธ์/สารนิพนธ์ เรื่อง

.........ANALYSIS OF PAIN DURING SMARTPHONE USE IN SITTING POSITION IN THE ELDERLY.........

ชื่อนิสิต.......นางสาวภิญญา ภูปภัสศิริ.....**หลักสูตร**...หลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาวิชากายภาพบำบัด...

การนำผลงานไปใช้ประโยชน์อย่างเป็นรูปธรรม : **กรุณากรอกการนำผลงานวิจัยไปใช้ประโยชน์โดยละเอียด ได้แก่ ระบุ วัน เวลา สถานที่ที่นำไปใช้ประโยชน์ ผู้นำไปใช้ประโยชน์ พร้อมแนบหลักฐาน เช่น รูปถ่ายหนังสือเชิญ หนังสือขอนำผลไปใช้ ฯลฯ (ถ้ามี)**

1. **ใช้ประโยชน์ในเชิงพาณิชย์**

   ระบุ -

   [ ] บริษัทเจรจาขอตัวอย่างผลิตภัณฑ์ / ถ่ายทอดงานวิจัย

   [ ] อยู่ระหว่างทำสัญญากับบริษัท

   [ ] อื่นๆ...

2. **ใช้ประโยชน์ทางสังคมและชุมชน เช่น การถ่ายทอดงานวิจัยสู่ชุมชนในรูปแบบต่างๆ**

   [ ] การฝึกอบรม

   [ ] การติดโปสเตอร์งานวิจัยในชุมชน / วัด / โรงเรียน

   [ ] การจัดทำคู่มือให้กลุ่มเป้าหมาย

   [✓] การจัดประชุมให้ความรู้กลุ่มเป้าหมายเฉพาะ

   [ ] อื่นๆ

3. **ใช้ประโยชน์ในเชิงนโยบายเพื่อใช้ประโยชน์ประกอบการตัดสินใจในการบริหาร หรือกำหนดนโยบาย**

   [✓] การนำเสนอข้อมูลที่เป็นประโยชน์ต่อหน่วยงาน

   [ ] อื่นๆ...

4. **การจดสิทธิบัตร, อนุสิทธิบัตร, ฉลากการค้า และอื่นๆ ที่เกี่ยวข้องกับทรัพย์สินทางปัญญา**

[✓] ไม่ได้จด [ ] อยู่ระหว่างการยื่นจด

[ ] ยื่นจด [ ] สิทธิบัตร ระบุ...

[ ] อนุสิทธิบัตร ระบุ...

[ ] ฉลากการค้า ระบุ...

[ ] อื่นๆ...

เมื่อปี พ.ศ. .... เลขที่...............................

5. **การนำผลงานเผยแพร่ในเว็ปไซต์ ระบุเว็บไซต์.....-.....**

ชื่อผลงาน...

ผู้นำขึ้นโพสต์...

ลงชื่อ..........(signature)..........

(นางสาวประทานพร ฉั่วอนุสรณ์)

นักกายภาพบำบัดชำนาญการพิเศษ

บริษัท/องค์กร...

หมายเหตุ: ผู้มีอำนาจโปรดลงนามพร้อมประทับตราองค์กร

Appendix D COVID-19 SCREENING QUESTIONARE

แบบคัดกรอง COVID-19

ชื่อ-สกุล (นาย/นาง/นางสาว)..............................**วัน/เดือน/ปี**..............................

เบอร์โทรศัพท์ที่สามารถติดต่อได้............................

ลำดับ	คำถาม	ใช่	ไม่ใช่	หมายเหตุ
1	มีอาการสงสัยโควิด-19			
	1.1มีไข้			
	1.2ไอ			
	1.3มีน้ำมูก			
	1.4เจ็บคอ			
	1.5หายใจเร็ว หรือหายใจเหนื่อย หรือหายใจลำบาก			
	1.6จมูกไม่ได้กลิ่น			
	1.7ลิ้นไม่รับรส			
2	สัมผัส/ใกล้ชิดผู้ติดเชื้อ ภายใน 14 วัน			
3	เข้าร่วมกิจกรรมที่มีการรวมกลุ่ม เช่น งานแต่งงาน งานบวช หรือ ร่วมวงดื่มเหล้า			
4	ใช้บริการโดยสารสาธารณะออกนอกพื้นที่/เขต จังหวัด			
5	ได้รับการตรวจโควิด-19 ภายใน 14 วัน			
6	กักตัว ควบคุมสังเกตอาการ ในระยะเวลา 14 วัน			
7	ได้รับการฉีดวัคซีน			
8	ใช้หน้ากากอนามัยเป็นประจำเมื่ออยู่นอกบ้าน			

หมายเหตุ...

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Appendix E PARTICIPANT INFORMATION SHEET

MF-10-1-version-2.0
วันที่ 18 ต.ค. 61

เอกสารชี้แจงผู้เข้าร่วมการวิจัย
(Participant Information Sheet)

ในเอกสารนี้อาจมีข้อความที่ท่านอ่านแล้วยังไม่เข้าใจ โปรดสอบถามหัวหน้าโครงการวิจัยหรือผู้แทนให้ช่วยอธิบายจนกว่าจะเข้าใจดี ท่านอาจจะขอเอกสารนี้กลับไปอ่านที่บ้านเพื่อปรึกษา หารือกับญาติพี่น้อง เพื่อนสนิท แพทย์ประจำตัวของท่าน หรือแพทย์ท่านอื่น เพื่อช่วยในการตัดสินใจเข้าร่วมการวิจัย

ชื่อโครงการวิจัย การวิเคราะห์อาการปวดขณะใช้งานสมาร์ทโฟนในท่านั่งในผู้สูงอายุ
ชื่อหัวหน้าโครงการวิจัย ผู้ช่วยศาสตราจารย์ ดร. ภัทริยา อินทร์โท่โล่
นางสาวภิญญา ภูปภัสศิริ

สถานที่วิจัย คณะกายภาพบำบัดมหาวิทยาลัยศรีนครินทรวิโรฒ องครักษ์ อ. องครักษ์ จังหวัดนครนายก
สถานที่ทำงานและหมายเลขโทรศัพท์ของหัวหน้าโครงการวิจัยที่ต่อได้ทั้งในและนอกเวลาราชการ
ผู้ช่วยศาสตราจารย์ ดร. ภัทริยา อินทร์โท่โล่ คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ
ถนน รังสิตนครนายก ตำบล องครักษ์ อำเภอ องครักษ์ จังหวัด นครนายก รหัสไปรษณีย์ 26120
โทรศัพท์ 084-944-5859
ผู้สนับสนุนทุนวิจัย อยู่ระหว่างการขอทุน ทุนอุดสถาบันยุทธศาสตร์ทางปัญญาและวิจัย มหาวิทยาลัยศรีนครินทรวิโรฒ
ระยะเวลาในการวิจัย 12 เดือน

โครงการวิจัยนี้ทำขึ้นเพื่อ เพื่อศึกษาอาการปวดกล้ามเนื้อคอ บ่า หลังส่วนบน หลังส่วนล่าง แขน และมือ ขณะใช้งานสมาร์ทโฟนในท่านั่งที่แตกต่างกันสามท่าทาง เป็นเวลา 15 นาที ในกลุ่มผู้สูงอายุที่มีอายุระหว่าง 60-69 ปี
ประโยชน์ที่คาดว่าจะได้รับจากการวิจัย เพื่อเป็นแนวทางในการแนะนำท่าทางที่เหมาะสมสำหรับการใช้งานสมาร์ทโฟนเพื่อป้องกันการเกิดอาการปวดทางด้านระบบกระดูกและกล้ามเนื้อในกลุ่มผู้สูงอายุ

ท่านได้รับเชิญให้เข้าร่วมการวิจัยนี้เพราะ ท่านเป็นผู้ที่มีอายุระหว่าง 60-69 ปี มีสมาร์ทโฟนเป็นของตัวเองและมีประสบการณ์ในการใช้งานสมาร์ทโฟนอย่างน้อย 2 ชั่วโมงต่อวัน และอย่างน้อย 2 วันต่อสัปดาห์ มีดัชนีมวลกายอยู่ในเกณฑ์ปกติในช่วง 18.5-22.9 kg/m^2 มีสายตาเป็นปกติ หรือได้รับการปรับให้เป็นปกติอย่างการสวมแว่นหรือคอนแทคเลนส์ และ ไม่มีอาการปวดที่บริเวณคอ ไหล่ หลังส่วนบน หลังส่วนล่าง แขน ข้อศอก และมือที่ต้องได้รับการรักษาด้วยแพทย์หรือนักกายภาพบำบัดเป็นระยะเวลา 1 สัปดาห์ก่อนเข้าก่อนศึกษา ไม่มีภาวะหลังค่อม ไม่มีอาการปวดก่อนเข้ารับการรักษาที่ต้องรับประทานยาแก้ปวดเป็นระยะเวลา 1 สัปดาห์ก่อนเข้าการศึกษา ไม่มีประวัติโรคทางระบบประสาท และไม่มีประวัติในการผ่าตัดกระดูกสันหลัง ไหล่ ข้อสะโพก หรือไม่มีภาวะกระดูกสันหลังคด

จะมีผู้เข้าร่วมการวิจัยนี้ทั้งสิ้นประมาณ 20 คน

หากท่านตัดสินใจเข้าร่วมการวิจัยแล้ว จะมีขั้นตอนการวิจัยดังต่อไปนี้คือ

1. ผู้เข้าร่วมวิจัยจะถูกคัดกรองตามเกณฑ์การคัดเข้า-ออก
2. ผู้วิจัยแจ้งข้อมูลของโครงการวิจัย หลักการ, เหตุผล, ความจำเป็นในการวิจัย และประโยชน์ของโครงการวิจัย ตลอดจนกระบวนการเก็บข้อมูล
3. ผู้เข้าร่วมวิจัยลงนามยินยอมเข้าร่วมวิจัย
4. ผู้วิจัยทำการบันทึกข้อมูลผู้เข้าร่วมวิจัย
5. ผู้วิจัยอธิบายขั้นตอนในการเก็บข้อมูลและการประเมินความรุนแรงของอาการปวดด้วยเครื่องมือ VAS รวมถึงการระบุตำแหน่งบริเวณที่มีอาการปวดด้วย Body pain chart และ Hand diagramให้แก่ผู้เข้าร่วมวิจัย
6. ผู้เข้าร่วมวิจัยจะถูกสุ่มท่าทางการใช้งานสมาร์ทโฟนทั้ง 3 ท่าทาง คือ 'ท่านั่งใช้งานสมาร์ทโฟนตามที่ต้องการ' 'ท่านั่งหลังตรง ถือสมาร์ทโฟนด้วยสองมือไว้ระดับอก' 'ท่านั่งหลังตรง ถือสมาร์ทโฟนด้วยสองมือไว้ระดับอก และมีที่รองข้อศอก' ดังภาพประกอบ2 ให้แก่ผู้เข้าร่วมวิจัย
7. ผู้เข้าร่วมวิจัยใช้งานสมาร์ทโฟนเป็นเวลา 15 นาที ในท่าทางที่สุ่มเลือกได้
8. บันทึกข้อมูลความรุนแรงของอาการปวดและบริเวณที่มีอาการปวดของกล้ามเนื้อ ซึ่งประกอบด้วย บริเวณคอด้านหลัง (posterior neck), บ่า (shoulder), แขน (arm), มือ (hand), หลังส่วนบน (upper back), หลังส่วนล่าง (lower back)
9. พัก 10 นาที ในท่านอนหงาย และไม่มีการทำกิจกรรมใดๆ ผู้เข้าร่วมวิจัยจะพักจนกว่าจะไม่มีอาการปวด ก่อนเริ่มใช้งานสมาร์ทโฟนในท่าต่อไป จนครบทั้ง 3 ท่าทาง

ความเสี่ยงที่อาจจะเกิดขึ้นเมื่อเข้าร่วมการวิจัย เสี่ยงที่จะมีอาการปวดจากกล้ามเนื้ออักเสบ จากการใช้งานสมาร์ทโฟนในท่านั่ง

วิธีแก้ไข หากมีภาวะอาการปวดจากกล้ามเนื้ออักเสบ และประสงค์จะหยุดการดำเนินการขณะเก็บข้อมูล ให้แจ้งผู้วิจัย ผู้ทำการวิจัยจะรับผิดชอบ โดยการรักษากายภาพบำบัดด้วยการนวดเบาๆ การยืดกล้ามเนื้อ หรือโดยใช้เครื่องมือปฐมพยาบาลเบื้องต้น เช่น cold pack และยาทาภายนอก เช่น Reparil gel เตรียมไว้ จนกว่าอาการปวดลดลง หรือ เมื่อพิจารณาแล้วหากมีอาการรุนแรงจะส่งตัวไปที่โรงพยาบาลที่ใกล้ที่สุด

หากท่านไม่เข้าร่วมในโครงการวิจัยนี้<u>จะไม่มีผลกระทบต่อหน้าที่การปฏิบัติงานใดๆ ของท่าน</u>

หากมีข้อข้องใจที่จะสอบถามเกี่ยวข้องกับการวิจัย หรือหากเกิดผลข้างเคียงที่ไม่พึงประสงค์จากการวิจัย ท่านสามารถติดต่อ ผู้ช่วยศาสตราจารย์ ดร. ภัทริยา อินทร์โท่ไล่ คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ องครักษ์ ตำบล องครักษ์ จังหวัด นครนายก เบอร์โทรศัพท์ 084-944-5859

ท่านจะได้รับการช่วยเหลือหรือดูแลรักษาการบาดเจ็บ/เจ็บป่วยอันเนื่องมาจากการวิจัยตามมาตรฐานทางการแพทย์ โดยผู้รับผิดชอบค่าใช้จ่ายในการรักษาคือ ผู้ช่วยศาสตราจารย์ ดร. ภัทริยา อินทร์โท่ไล่ คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ องครักษ์ ตำบล องครักษ์ จังหวัด นครนายก เบอร์โทรศัพท์ 084-944-5859

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ประโยชน์ที่คิดว่าจะได้รับจากการวิจัย ได้ข้อมูลการใช้งานสมาร์ทโฟนในท่าทางที่ทำให้อาการปวดน้อย ขณะที่ผู้สูงอายุใช้งานสมาร์ทโฟน และจะเป็นข้อมูลที่จะรวมไปเป็นคำแนะนำสำหรับผู้สูงอายุให้ใช้งานสมาร์ทโฟนให้ถูกหลักวิชาการ เพื่อลดความเสี่ยงในการบาดเจ็บของกล้ามเนื้อ

ค่าตอบแทนที่ผู้เข้าร่วมการวิจัยจะได้รับ 500 บาท ต่อคน

ค่าใช้จ่ายที่ผู้เข้าร่วมการวิจัยจะต้องรับผิดชอบเอง ไม่มี

หากมีข้อมูลเพิ่มเติมทั้งด้านประโยชน์และโทษที่เกี่ยวข้องกับการวิจัยนี้ ผู้วิจัยจะแจ้งให้ทราบโดยรวดเร็วและไม่ปิดบัง

ข้อมูลส่วนตัวของผู้เข้าร่วมการวิจัย จะถูกเก็บรักษาไว้โดยไม่เปิดเผยต่อสาธารณะเป็นราย บุคคล แต่จะรายงานผลการวิจัยเป็นข้อมูลส่วนรวมโดยไม่สามารถระบุข้อมูลรายบุคคลได้ ข้อมูลของผู้เข้าร่วมการวิจัยเป็นรายบุคคล อาจมีคณะบุคคลบางกลุ่มเข้ามาตรวจสอบได้ เช่น ผู้ให้ทุนวิจัย สถาบัน หรือองค์กรของรัฐที่มีหน้าที่ตรวจสอบ รวมถึงคณะกรรมการ จริยธรรมการวิจัยในคนมีหน้าที่ตรวจสอบได้ โดยจะเก็บข้อมูลไว้นาน 5 ปี และระหว่างเวลาดังกล่าว จะไม่นำข้อมูลใช้ใดๆ

ผู้เข้าร่วมการวิจัยมีสิทธิ์ถอนตัวออกจากโครงการวิจัยเมื่อใดก็ได้ โดยไม่ต้องแจ้งให้ทราบล่วงหน้า และการไม่เข้าร่วมการวิจัยหรือถอนตัวออกจากโครงการวิจัยนี้ จะไม่มีผลกระทบต่อการบริการและการรักษาที่สมควรจะได้รับตามมาตรฐานแต่ประการใด

หากท่านได้รับการปฏิบัติที่ไม่ตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงนี้ ท่านสามารถแจ้งให้ประธานคณะกรรมการจริยธรรมการวิจัยในคนทราบได้ที่ สำนักงานคณะกรรมการจริยธรรมการวิจัยในมนุษย์ สถาบันยุทธศาสตร์ทางปัญญาและวิจัย อาคารศาสตราจารย์ ดร.สาโรช บัวศรี ชั้น 20 โทร (02) 649-5000 ต่อ 11019 โทรสาร: (02) 259-1822

ลงชื่อ... **ผู้เข้าร่วมโครงการวิจัย**

(...)

วันที่..

คณะกรรมการจริยธรรมในมนุษย์

คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ

รหัส PTPT2022-001 **วันที่** 8 กุมภาพันธ์ 2565 **ถึง** 7 กุมภาพันธ์ 2566

Appendix F INFORMED CONSENT FORM

MF-10-2-version-2.0
วันที่ 18 ต.ค. 61

หนังสือให้ความยินยอมเข้าร่วมในโครงการวิจัย
(Informed Consent Form)

วันที่ ....

ข้าพเจ้า..อายุ...ปี

อยู่บ้านเลขที่.......................ถนน...หมู่ที่.......................แขวง/ตำบล..

เขต/อำเภอ...จังหวัด..โทรศัพท์...

ขอทำหนังสือนี้ให้ไว้ต่อหัวหน้าโครงการวิจัยเพื่อเป็นหลักฐานแสดงว่า

ข้อ 1 . ข้าพเจ้า ได้รับทราบโครงการวิจัยของ ผู้ช่วยศาสตราจารย์ ดร. ภัทริยา อินทร์โท่โล่
นางสาวภิญญา ภูปภัสศิริ
เรื่อง การวิเคราะห์อาการปวดขณะใช้งานสมาร์ทโฟนในท่านั่งในผู้สูงอายุ

ข้อ 2. ข้าพเจ้า ยินยอมเข้าร่วมโครงการวิจัยนี้ด้วยความสมัครใจ โดยมิได้มีการบังคับขู่เข็ญ หลอกลวงแต่ประการใด และจะให้ความร่วมมือในการวิจัยทุกประการ

ข้อ 3. ข้าพเจ้า ได้รับการอธิบายจากผู้วิจัยเกี่ยวกับวัตถุประสงค์ของการวิจัย วิธีการวิจัย ประสิทธิภาพ ความปลอดภัย อาการหรืออันตรายที่อาจเกิดขึ้น รวมทั้งแนวทางป้องกัน และแก้ไข หากเกิดอันตราย ค่าตอบแทนที่จะได้รับ ค่าใช้จ่ายที่ข้าพเจ้าจะต้องรับผิดชอบจ่ายเอง โดยได้อ่านข้อความที่มีรายละเอียดอยู่ในเอกสารชี้แจงผู้เข้าร่วมโครงการวิจัยโดยตลอด อีกทั้งยังได้รับคำอธิบายและตอบข้อสงสัยจากหัวหน้าโครงการวิจัยเป็นที่เรียบร้อยแล้ว และตกลงรับผิดชอบตามคำรับรองในข้อ 5 ทุกประการ

ข้อ 4. ข้าพเจ้า ได้รับการรับรองจากผู้วิจัยว่าจะเก็บข้อมูลส่วนตัวของข้าพเจ้าเป็นความลับ จะเปิดเผยเฉพาะผลสรุปการวิจัยเท่านั้น

ข้อ 5. ข้าพเจ้า ได้รับทราบจากผู้วิจัยแล้วว่า หากมีอันตรายใด ๆ **อันเกิดขึ้นจากการวิจัยดังกล่าว** ข้าพเจ้าจะได้รับการรักษาพยาบาลจากคณะผู้วิจัย โดยไม่คิดค่าใช้จ่ายและจะได้รับค่าชดเชยรายได้ที่สูญเสียไปในระหว่างการรักษาพยาบาลดังกล่าว ตลอดจนมีสิทธิ์ได้รับค่าทดแทนความพิการที่อาจเกิดขึ้นจากการวิจัยตามสมควร

ข้อ 6. ข้าพเจ้า ได้รับทราบแล้วว่าข้าพเจ้ามีสิทธิ์จะบอกเลิกการร่วมโครงการวิจัยนี้ และการบอกเลิกการร่วมโครงการวิจัยจะไม่มีผลกระทบต่อการดูแลรักษาโรคที่ข้าพเจ้าจะพึงได้รับต่อไป

ข้อ 7. หากข้าพเจ้ามีข้อข้องใจเกี่ยวกับขั้นตอนของการวิจัย หรือหากเกิดผลข้างเคียงที่ไม่พึงประสงค์จากการวิจัย สามารถติดต่อกับ

- ผู้ช่วยศาสตราจารย์ ดร. ภัทริยา อินทร์โท่โล่ เบอร์โทร 084-944-5859
- นางสาวภิญญา ภูปภัสศิริ เบอร์โทร 086-362-0622

ข้อ 8. หากข้าพเจ้า ได้รับการปฏิบัติไม่ตรงตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าจะสามารถติดต่อกับประธานคณะกรรมการจริยธรรมสำหรับการพิจารณาโครงการวิจัยที่ทำในมนุษย์หรือผู้แทน ได้ที่สถาบันยุทธศาสตร์ทางปัญญาและวิจัย มหาวิทยาลัยศรีนครินทรวิโรฒ โทรศัพท์ 02-649-5000 ต่อ 11019

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วันที่ 18 ต.ค. 61

/ ข้าพเจ้า.....

ข้าพเจ้าได้อ่านและเข้าใจข้อความตามหนังสือนี้โดยตลอดแล้ว เห็นว่าถูกต้องตามเจตนาของข้าพเจ้า จึงได้ลงลายมือชื่อไว้เป็นสำคัญพร้อมกับหัวหน้าโครงการวิจัยและต่อหน้าพยาน

ลงชื่อ	ลงชื่อ ....
(...)	(...)
ผู้ยินยอม / ผู้แทนโดยชอบธรรม	ผู้ให้ข้อมูลและขอความยินยอม/หัวหน้าโครงการวิจัย

ลงชื่อ ....พยาน	ลงชื่อ ....พยาน
(...)	(...)

ในกรณีที่ผู้เข้าร่วมการวิจัย อ่านหนังสือไม่ออก ผู้ที่อ่านข้อความทั้งหมดแทนผู้เข้าร่วมการวิจัยคือ.................................... จึงได้ลงลายมือชื่อไว้เป็นพยาน

ลงชื่อ ....พยาน
(...)

หมายเหตุ

1. ในกรณีผู้ให้ความยินยอมมีอายุไม่ครบ 18 ปีบริบูรณ์ จะต้องมีผู้ปกครองตามกฎหมายเป็นผู้ให้ความยินยอมด้วย หรือผู้ป่วยที่ไม่สามารถแสดงความยินยอมได้ด้วยตนเอง จะต้องมีผู้มีอำนาจทำการแทน เป็นผู้ให้ความยินยอม
2. กรณีผู้ยินยอมตนให้ทำวิจัย ไม่สามารถอ่านหนังสือได้ ให้ผู้วิจัยอ่านข้อความในหนังสือให้ความยินยอมนี้ให้แก่ผู้ยินยอมตนให้ทำวิจัยฟังจนเข้าใจแล้ว และให้ผู้ยินยอมตนให้ทำวิจัยลงนาม หรือพิมพ์ลายนิ้วหัวแม่มือรับทราบ ในการให้ความยินยอมดังกล่าวด้วย

คณะกรรมการจริยธรรมในมนุษย์

คณะกายภาพบำบัด มหาวิทยาลัยศรีนครินทรวิโรฒ

รหัส PTPT2022-001 **วันที่** 8 กุมภาพันธ์ 2565 **ถึง** 7 กุมภาพันธ์ 2566

Appendix G DATA COLLECTION FORM

Date ....

Data collection form

Name_______________________________ Age___________

Sex ☐ Male ☐ Female

Height_________cm Weight_______kg BMI_______Kg/m^2

Hand dominance ☐ Rt. ☐ Lt.

OWD (Kyphosis test) less than 5 cm…………………………….cm ☐ normal

Scoliosis (Observation) ………………………………………….. ☐ normal

Eye test ………………………………………………………. ☐ normal

She/He has her/his own eyeglasses ☐ Yes

Data collection

Position 1

☐ Preferred sitting position

☐ Sitting upright and holding the smartphone with two hands at chest level

☐ Sitting upright with arm support and holding the smartphone with two hands at chest level

Location of pain	Severity of pain (VAS)
Neck	
Shoulder	
Arm	
wrist	
Hand	
Upper back	
Lower back	
Eyes	

Note:___________________________

Position 2

☐ Preferred sitting position

☐ Sitting upright and holding the smartphone with two hands at chest level

☐ Sitting upright with arm support and holding the smartphone with two hands at chest level

Location of pain	Severity of pain (VAS)
Neck	
Shoulder	
Arm	
wrist	
Hand	
Upper back	
Lower back	
Eyes	

Note:___________________________

Position 3

☐ Preferred sitting position

☐ Sitting upright and holding the smartphone with two hands at chest level

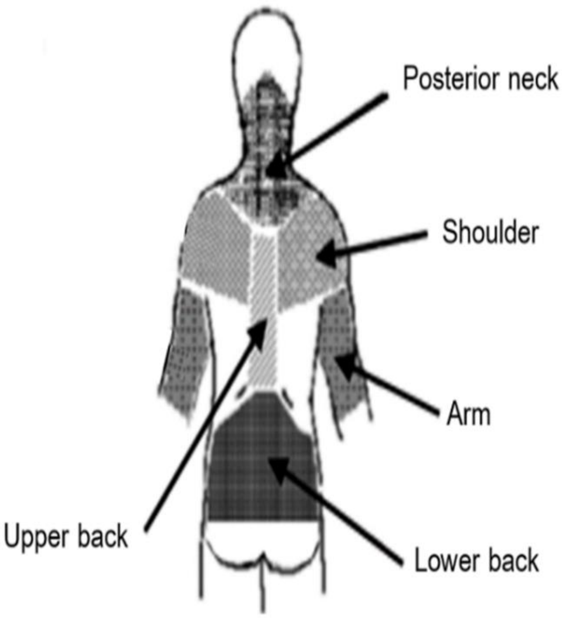
☐ Sitting upright with arm support and holding the smartphone with two hands at chest level

Location of pain	Severity of pain (VAS)
Neck	
Shoulder	
Arm	
wrist	
Hand	
Upper back	
Lower back	
Eyes	

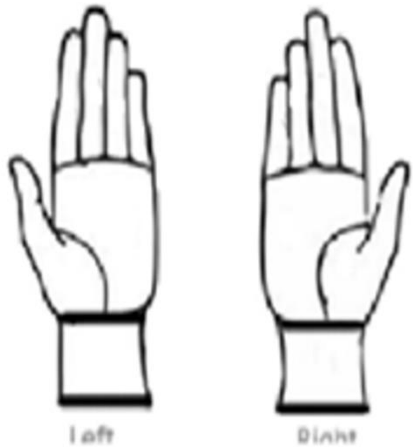
Note:___________________________

Note:____

Appendix H Body pain chart and Hand diagram



Body pain chart



Hand diagram

Appendix I Measurement of Occipital-to-wall distance (OWD)

VITA

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