CHAPTER II

REVIEW OF LITERATURE
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This chapter deals with the review of published and unpublished research studies and non-research literature related to the present study.

It is essential and important to review many literatures which are related to our study project to prove it scientifically. It helps the researcher to extend a deeper knowledge about the problem and gain some points on what is already done before in this field and through light on what has to be done on newer studies. It gives justice to the need for repetition of the study and throws light on the possibility and feasibility of the study. It also can work as limitation of data collection, and helps to correlate the findings from one study to another. Reviewing the literature helps to expose talented procedural tools, which drops light on the ways to get good organization of the data collection? Review also helps the Researcher to decide why he is conducting the study and provide ideas of practicability to conduct study.

Review of Literature is organized detection, location, analysis, and abstract of the written resources that include some informal points on related research statements. Here the Investigator has made some attempt to follow some steps in the review of related research to expand the understanding and to gain an insight into the selected problem under study. Investigator has done manual as well as MEDLARS, PUBMED, and DELNET search for the review of related literature.

Ancient philosophers called the human senses the windows of the soul. It was described by Aristotle that human beings have 5 senses i.e. smell, hearing, touch and taste. Aristotle’s wordings were very strongly influenced people and many people till now believe there are only 5 senses. But the current sensory index includes kinaesthetic sense i.e. receptors in the muscular skeletal system, Receptors in the inner ear which give rise to the sense of equilibrium, sensory receptors in the circulatory system which are sensitive to CO₂ in the blood or to changes in blood pressure. In GI system hunger and thirst receptors are there. Hypothalamus contains organs sensitive to changes in blood chemistry. Vision is stimulated by light.

Human senses are of interdisciplinary category. Many scientists from various disciplines have done many studies on sensory activities. Psychologists on mind, physicists on aural sense, and chemists with various chemicals etc, which are considered as important.
contributions in the field of sensory researches. In recent days more studies are conducted by using equipments which stimulate and improves sensory functions. The literature reviewed was organised under the following headings:

1. Literature related to stroke in general.
2. Literature related to Multi Sensory Stimulation
3. Literature related to Auditory Stimulation
4. Literature related to Mirror Therapy
5. Literature related to Olfactory Stimulation
6. Literature related to Gustatory Stimulation
7. Literature related to Tactile Stimulation
8. Literature related to neurological outcome of stroke patients in general

LITERATURE RELATED TO STROKE IN GENERAL

The nervous system is one of the most important and complex systems in the human body. This network of nerve cells, fibers, and neurons plays a part in every bodily function, including thoughts, sensations, and movements. Injury or illness to any part of the nervous system will often result in devastating consequences, which can range from paralysis to psychosis to death.

A study on stroke Global senses on Stroke Morbidity and Mortality reveal that out of 1,00,000 population 400 -800 people suffer from stroke. Globally 5.7 million deaths occur due to stroke every year. Every year 15 million people suffer with acute stroke, 0.63 million deaths, 28,500,000 DALYs (disability-adjusted life-year) and 12% of strokes occur in the population aged <40 years.1

Since long period it is a known factor that stroke is an emergency situation at the beginning and slowly become a chronic condition it affects the victim’s physical, cognitive, and emotional functioning. Yu-Hsiu Hung et al (2015) conducted a study with a purpose to develop equipment for upper arm rehabilitation based on multi sensory stimulation programme for stroke patients. 17 professional therapists individually evaluated the effectiveness of rehabilitation using seven hand gestures with mirror therapy with multiple stimulation like auditory, tactile, thermal, electrical, and vibration stimulation. The result revealed that this technique of rehabilitation practice had a major effect and vibration stimulus & mirror treatment were most effective. These findings of the study encouraged the
researchers to design equipments vibration stimulus and mirror treatment which stimulate multisensory organs.\textsuperscript{35}

**LITERATURE RELATED TO MULTI SENSORY STIMULATION**

An article on ‘sensory stimulation to brain injury patients in coma or vegetative state’ was published in Anthem (2014). According to writer of this article sensory stimulation is planned for augmenting the rehabilitative ability of brain injured patients in an unconsciousness state. Protocols can be prepared to stimulate visual, gustatory, auditory, cutaeneous sensations periodically. Professionals from Health care like nurses, physiotherapists, speech therapists can be included to perform the sensory stimulation therapy. Primary responsibility of providing the therapy can be given to family members who are trained in this technique. Therapy may be given in hospital, nursing homes, or in patient’s home.\textsuperscript{36}

Angelica MT et al (2016) reviewed some research studies based on sensory stimulation programme. Their review study summarize that activities of daily living like recognizing the things, exploration, identification, localization and some activities of daily living could be improved by the treatment of multisensory stimulation in patients with sensory impairments with various grades. Many studies have reported hopeful results of multisensory stimulation in patients with severe sensory impairments after brain attacks. After this review study they also commented that more and more studies needs to be conducted on this subject i.e. on multi sensory stimulation.\textsuperscript{37}

A Research Project (2016) was conducted by European commission to see the effect of giving multisensory stimulation in early stage of stroke attack, on cognitive and perceptual functions of stroke patients with unilateral neglect. The report of this project summarize that patients with stroke, with cognitive and perceptual problem can be better treated by multisensory signalling. The benefits of multisensory processing can generalize to complex task such as search and memory. These outcomes have broad clinical and social implication. Outcome in patients with perceptual and cognitive impairments after stroke is very poor. Better rehabilitation strategies for these patients aiming at faster recovery would not only improve prognosis, but could promote a better quality of life. Even the ageing population in general can benefit from multisensory signalling to improve functional independence and quality of life.\textsuperscript{38}
LITERATURE RELATED TO AUDITORY STIMULATION

Since ancient period nurses are using music as an auditory stimulation in clinical area to unconscious patients, stroke patients, brain injury patients. It is scientifically proven that using music as stimulation helps in improving emotional, physical, cognitive, and social integrational recovery. There is a rising interest in musical stimulation approaches as an addition to standard care in clinical practice and in the field of medical science. Nurses very commonly use music as stimulation to their patients admitted with CNS related problems and for patients suffering from sleeplessness to improve sleep and to alleviate apprehension, sadness and depression.

A cerebral stroke or brain attack is a life changing incident to the victims. Many research studies have proven that providing music therapy after stroke have significant positive role in neurological improvement of stroke patients. It also helps to reduce the stroke effects and to enhance the QOL of the patients. But Music therapy needs to be given with the routine medical treatment but not alone. Flowing music can help to improve movement and muscular control of the patients. For eg, playing a drum may improve ROM of the arm, or/and walking can be improved by musical beats. Music treatment to stroke patients can also improve control of the limb muscles. Music Listening enhance cognitive functions, attention span, memory power, organization of thoughts, and problem solving ability. Recovery of speech and interaction can be speed up by encouraging patients to act in response to the music by singing, associated with dancing. (2015).39

Music therapy helps the patients to improve and maintain their physical and mental health status. Music therapy also helps to improve emotional wellbeing, social status, aesthetic sense, and spiritual aspects. Singing and listening songs, discussing music, dancing with music, and songwriting improve patient’s functioning capacity and QOL in special aspects like improved motor activity, cognitive capacity, social skills, behavior skills, etc.

Brain has great capacity to process and integrate multiple sensory information concurrently. So one can learn better in multisensory environment. Combining stimulations from diverse sensory equipments and modalities improve one’s skill to sense, differentiate, and identify sensory stimuli. Stimulation of brain has shown hopeful results in aphasia and neglect. As human beings exists in a multisensory surroundings, the communication between genes and atmosphere forms human brains.7

Impairment in upright posture and gait is a common effect of stroke. Good postural control is necessary for stabilizing the body in different positions during voluntary
movements and for activities of daily living (ADL). Sensory stimulation may improve functional outcome after stroke. Stroke patients received sensory stimulation improved faster and to a better degree than control group clients. (2013).  

In this study the Researcher has used shehnai music as auditory stimulation. The Shehnai also called as Mangal Vadya is a double reed oboe, commonly used in India, Pakistan, Bangladesh and Iran. The instrument is made up of timber wood, with a metal flicker bell at one end. The sound created by this instrument maintains a sense of support and religiousness. That is why it is widely used in marriages, parades and in religious temples. Shenai is alike South India’s Nadaswaram. There are studies to see the effect of music therapy but not with a particular music like shehnai.  

Capability of the brain to streamline itself for new acquaintances is called Brain plasticity. Many researchers are using this idea to have new therapies for new disease conditions. Paul B.R (2008) has tried to develop new devices to provide sight to blind people and lessen a feeling of fall in patients who has lost function of the middle ear. Researches had shown that many sense organs have the capacity to recover itself after any damage. In same way auditory cognition also had shown to have little possible recovery in post stroke state. A study by Sarkamo et al has shown that music listening and audio books can help for early cognitive recovery of patients after stroke.

Kim DS et al (2011) studied the effect of MT on depressive mood and anxiety in post stroke clients. They also evaluated the satisfaction level of patients and care givers. Researchers included 18 patients with stroke up to 6 months from stroke attack who are having MMSE score over 20. Patients were assigned for music stimulation and control groups. Music therapy program was given to experimental group for four weeks. psychological parameters were evaluated before and after MT. using BAI (Beck Anxiety Inventory) and BDI (Beck Depression Inventory). Questionnaire is prepared and used to get satisfaction level with therapy implemented to control group. After evaluation of data it is found that there was a greater reduction in BAI and BDI scores in experimental group who has received music therapy than the control group, without music therapy, with a p value of p=0.048. Result of Satisfaction regarding music therapy in patients and their caregivers found to be positive. The study concludes that music therapy is helpful in improving mood and decreasing anxiety of stroke patients.  

In an article published in the e-journal (2016) At A Glance, with a heading ‘Music therapy helps in recovery of post stroke’ state that music can enhance spontaneous
movements and intensive music can improve relationship so that the stroke patients are always engaged and are out of loneliness and depression. This article is the summary of discussion taken place by team of clinical doctors and researchers at the Nor doff Robbins Centre for Music Therapy. An interventional tool called Music Upper Limb Therapy Integrated (MULTI) was designed by Langone to deal with human domains like physical, mental and social aspects in stroke rehabilitation. Music therapy was given to thirteen stroke for 45 minutes, two times in a week for six weeks. The researchers observed that there is reduced impairment of upper limbs and shoulders of participants receiving music treatment. Researchers also observed that music therapy improved sensory impairment, movement restriction and over all well being of the samples.  

The positive effect of SSP in post stroke has been observed in quite a few studies. Mackay et al (1992) conducted a study on effectiveness of rehabilitation of stroke in a formalized rehabilitation centre with patients without any formal rehabilitation practice. Researchers found that the patients in coma admitted in and receiving formal rehabilitation centres had reduced length of hospital stay than the patients in non formalized programs.  

According to Sarkamo et al (2008) till today there is an unanswered question that whether music can be a used as complementary treatment to improve neural mechanism and there by cognition of patients. According to these researchers there is naturally some improvement in arousal of the patients after neural injury. It may not be the effect of music therapy. The data related to focused attention and verbal memory in this study were proved this points significantly. Researchers concluded that music has got general and non specific effect on cognition.  

It was already proven since long time that music has got healing effect. (2011) many were using music as therapeutic agent for many diseases. Music is considered as a type of yoga study by Indians. We think that ragas help to awaken human sense organs and helps for their normal functioning. Indian music’s are melodious and Raga is considered as origin of this melody. Diseases related to CNS are greatly affected by ragas and were used often as complementary treatment in clinical areas.  

Since historical time Music is used by all the civilization to celebrate, grieve, communicate and to reply human feelings. During first and second world wars first time the volunteers played instruments to provide music therapy to patients injured in battle field. When medical professionals observed that there was a considerable improvement in patients
physical and mental conditions they started using music therapy with some definite intentions. Thus started the professional music therapy in mid 1900. 43

According to Chrissy W (2010) using music can increase the process speed of recapturing cognitive or decision making functions of brain. A music counsellor helps to improve the patient’s awareness about his or her neglected side by playing instruments on affected side and it will help to decrease the agitation. Power and strength in motor control exercises can be strengthened by hitting the drum with musical rhythm. This technique is called TIMP (therapeutic instrumental music playing). Immense researches has been done in ‘gait training’ with music. A stroke patient may walk unequally, with or without a support, and may walk lamely. By observing the client’s gait music therapist, will try to create a stable, specific rhythm that matches the speed of the patient. This will help client to get trained to the rhythm very fast and he tries to walk in a normal pattern. This method is called Rhythmic Auditory Stimulation (RAS). It has been first and foremost researched with Parkinson’s patients and later it is proven that this technique is effective in stroke patients also. 44

According to Chrissy W (2010), ‘A popular and widely successful music therapy technique for stroke patients with aphasia is Melodic Intonation Therapy (MIT)’. MIT emphasizes the accepted modulation of a phrase to resume communication skills. Primarily MIT was used for clients with aphasia, in later periods it was proved that MIT is very usefull to improve apraxia and dysarthria. Some other techniques like singing, verbal stimulation, fill the gap songs, and speech with a particular rhythm are often useful to patients with aphasia, dysarthria, or apraxia. 44

In an article published in a journal it is stated that music therapy is scientifically proven to be an effective tool for rehabilitation of stoke patients. It helps in the early recovery of movements of affected part and muscle control, verbalization, thinking, temper changes after stroke. ROM and Muscle Control can be enhanced by beating the drum. It also improve gait of the patients. Verbalization and Communication can be enhanced by exercise of muscles of oral cavity by adding some phrases to music, by transferring words from singing to speech Rhyming, striking with repeated rapid audible blows, especially in order to attract attention, chanting etc. can be improved. Music containing significant information, playing music in crowd and games with certain rhythm can improve various aspects of cognition like attention, problem solving capacity, memory power and organizing thoughts. This motivates the clients to get better. 31
Listening music activates wide spread bilateral network of brain parts In human beings parts related to attention, motor functions, emotional and semantic processing, memory etc. Exposure to Music therapy enhances emotional and cognitive functioning in healthy people and in various clinical patient groups. There are no enough studies on the possible role of music in neurological rehabilitation. The staff of Helsinki University central hospital Canada has conducted a single blind randomised controlled trial to find out the effect of listening music daily on recovery of cognitive functions and mood in CVA patients. Researchers selected 60 samples with acute ischemic MCA stroke, (left or right temporal, frontal, parietal and sub cortical brain lesions) without any previous history of neurological and mental disease, no substance abuse, without any hearing defect, right sided, 75 years age and able to cooperate, for study. Samples randomly assigned to experimental group with music therapy, a language group and a control group. All samples were studied for two months. Music was provided to music group, language group listened audio books and control group studied without any intervention. All samples were treated medically with routine treatment. Neurological assessment was done to all the patients. Quality of life is also assessed out of 60 samples 54 patients completed the study.

Study results proved that listening music regularly can improve thinking capacity and develop positive mood in stroke patients. Music group samples had shown greater improvement in focused thought and vocal memory than patients with audio books and control group. These findings proved that music was more effective in improving cognitive recovery and to develop positive moods after stroke attack (2008).

Brain attack is the most common neurological problem which may lead to auditory processing disorders. Salehi N (2008) found that music can stimulate multiple parts of the brain related to sensory processing, thought, recollection, complex cognition & multisensory integration. Listening to rhythmic music activates the brain parts related to motor activities and can recover gait and arms strengths. Listening music daily may help to get better verbal memory and better thoughts after stroke. The researchers conclude that post stroke problems are very common and may cause impairment in social interaction. Musical practice shapes brainstem encoding and results in improved ability to hear speech in noisy environment also.

Researches related to human physiology has shown the effect of auditory rhythm on motor system. There are researches which have proved that brain connectivity can be enhanced by aural stimulation. Human auditory organs work very fast and accurate and
project information into motor structures in the head. This action encourage brain tissues and their by make people to enjoy music with dance. Based on these phenomena, many clinical research studies were done and it was proven that rhythm and music produce a functional change in various neurological diseases like brain trauma, brain attack, Parkinson’s disease etc. the above factor is strongly proven with rhythmic auditory stimulation.

A review article by Michael H. regarding ‘Rhythmic auditory stimulation helps in the rehabilitation of stroke patients’ state that since long period of cultural history melody and physical movement (dance) were always considered as having a close effective relationship. This connectivity of rhythm and action are scattered in parallel fashion all over the brain.46

According to Teppo S, a Finnish researcher, daily music listening for few hours can significantly help in recovery of patients after stroke attack. A research study on 54 samples with right or left MCA infarct showed considerable progress in speech, memory and preset attention after two months of music therapy. Patients on music therapy had more optimistic attitude compared to those who listened to other audio sessions. Based on this results Sarkamo (2008) suggests that music listening should be a part of daily rehabilitation treatment, since it can be provided effortlessly to patients and it is less luxurious means to facilitate mental and emotional healing. In this research researchers had assigned patients in three groups and for each group they gave different interventions i.e. music therapy to one group, listening audio book to other group, and a third group i.e. control group without any stimulations. After 3 months the team found that verbal memory improved by 60% in music listeners, 18% in audio book listeners and 29% in non listeners. Similarly about focused attention the capacity to manage and carry out intellectual operations enhanced by 17% in music group but no progress was seen in other two groups.22

In a review study with a title ‘Music therapy in stroke rehabilitation’ Joanna and Pope (2013) stated that in recent day music therapy is used very commonly as a complementary treatment with routine rehabilitation. Music is a strong stimulus which has overall influence on human body organs and activates brain structures which has related influence on sensory processing, thought process, and memory power. Music can also stimulate multifaceted cognition and multisensory integration. Worldwide stroke is considered as one of the most expensive and long term disabling condition.47
LITERATURE RELATED TO MIRROR THERAPY

Mirror therapy is an intervention that uses a mirror to create mirror image of the non-paretic upper or lower limb and make the patient to think that his paretic limb is moving. Mirror therapy can be used for a different type of pain and disability conditions mainly for problems such as complex regional pain syndrome, phantom limb pain, paralysis and focal dystonia. Mirror therapy is successful in relieving pain and so used by many individuals. But while giving mirror therapy patient’s needs to show that he is able to follow the instruction to some extent. Than only the mirror therapy may be successful. The brain consists of billions and trillions of neurons and connections. As brain represents our body we are able feel the things. Playing a musical instrument in a repetitive meaningful way by using his hands, represents that more brain area of this person is dutiful than a person’s brain who is not playing instruments. Brain has the capacity to change fast, so the longer the problem persists, there is greater chances of more brain damage. Brain can be tricked by using mirror to make it to believe that the wounded part is in fact okay, and thus can provide a powerful synaptic training. For e.g. If the problem is problem is with left hand, that is to be hidden and by using the mirror image of the right hand the brain would create an imagination that the left hand is presently in working condition. In this way the brain is signalled as ‘there is no much problem with the injured hand and can be used as usual.’

Ramachandran and Rogers Ramachandran first designed and planned to use the technique and tried to help patients with ‘phantom limb’. Mirror Therapy affect the mirror neuron system in the brain, and it is found that there by it enhance cortical & spinal motor actions. 20% of total neurons present in brain are Mirror Neurons. Mirror neurons in the brain are responsible to distinguish between the right and left side of human body. When Mirror box is used, mirror neurons get excited and help in the improvement of injured parts. It is believed that this structure make use of observation of activities to excite the motor process which would be included in the movement. Brain’s natural leaning power to prioritize visual response had made Mirror Therapy a more effective tool.

A study conducted by Myoung K.K. et al (2016) with an objective of ‘examining the effects of mirror therapy on balance ability of subacute stroke patients.’ Seventeen stroke patients were assigned to MT (Mirror Therapy) with equal number of stroke patients in control group. Samples in the trial group received Mirror Therapy and usual rehabilitation treatment for sixty minutes daily, with 10 minute gap between 2 interventions for 4 weeks. Patients of control group received placebo effect and usual rehabilitation treatment for a
total of sixty minutes for same period. Balance Index (BI) was assessed using a stability measurement system. There was a significant variation in stability index of post training gains. Medial and side stability index was seen between the exp. group and control group with p value < 0.05. As the balance index score of experimental group better than control group this study concludes that MT may be helpful in recovering balance ability stroke patients. 41

A study conducted by Marian et al (2011) in an American hospital on motor recovery and cortical reform after giving MT in chronic stroke patients with an objective to assess clinical effects of home based Mirror Therapy & consequential cortical progress in clients having chronic stroke state with modest upper extremity problem. Researches selected forty chronic patients with stroke and were randomly assigned twenty in experimental and twenty in control group. All the samples in the study joined a 42 days training program. Both groups were taught about Mirror Therapy under the direction of a physical therapist at the rehabilitation centre and practiced 1 hour daily at home, five times /week. The main result was calculated by using Fugl Meyer motor assessment scale. The force of hand grip, spasticity, pain, task performing skill, hand use for Activities of Daily Living, and Quality Of Life were measured at baseline, after completion of therapy and after six months by using a blinded assessor. Effectiveness on Neural Activation Patterns was studied using functional Magnetic Resonance Imaging (fMRI) before intervention & aftervention to study samples i.e. experimental twelve and control nine. Post treatment, ‘Fugl Meyer motor assessment’ score increased more in mirror group than in control group. But no changes were seen on the former outcome process. Results revealed a change in activation stability in the mirror group with a difference minimal difference. This results of the study concludes that Mirror Therapy is helpful in old stroke patients also and is the first factor to associate MT in cortical reform. 49

A randomized controlled trial study was conducted by Nigar G. et al. (2016) on effect of Mirror Therapy on motor functions of upper extremity in stroke patients. They compared routine rehabilitation programme with Mirror Therapy in this study assessed motor functions of upper extremity. Researchers included 31 hemiplegic patients and were assigned in two groups randomly, 16 in experimental group and 15 in routine rehabilitation group. The samples in both groups received routine rehabilitation therapy for 60-120 minutes for five days / week for four weeks. The mirror experimental group received Mirror Therapy. They did flexion and extension of wrist and fingers of non affected hand
periodically. The same actions are done by control group also but in front of non reflecting side of mirror. The pre and post evaluation was done by a blinded evaluator using Brunnstrom Stage Fugl Mayer assessment score and Functional Independence measure self care score. Noticed improvement in Brunnstorm stage and the Functional Independence Measure (FIM) self care score in both groups, but post treatment Functional Assessment Measure (FMA) score was considerably elevated in Mirror Therapy group than regular treatment group. These findings conclude that Mirror Therapy as an additional treatment to a regular rehabilitation program which provides supplementary advantage in motor recovery of upper extremity in stroke patients.\textsuperscript{50}

Park J.Y et al (2015) conducted a research study with a purpose of examining the effects of Mirror Therapy on upper extremity function and on ADL in chronic stroke patients. 30 samples were selected for the study after doing MMSE with a score \( \geq 24 \). Samples are assigned for MT group and simulated group. Fugl Meyer motor function assessment and box and block test were done to evaluate upper extremity of the paralysed limb function and co-ordination ability of hand. Independent functional ability is measured to evaluate abilities to do ADL. It was found that paralysed upper limb function and coordination abilities of hand were considerably changed among the MT and simulated groups. Intervention in MT group was more successful than in the simulated group for getting better the ability to carry out ADL. Statistical difference was seen in both the group which is very significant in the study. The study concludes that improvement in paretic upper extremity function and ADL can be enhanced by the implementation MT.\textsuperscript{51}

A pilot study was conducted by Snehal N.W. et al (2015) in Ahmednagar, Maharashtra, India to see the effect of Mirror Therapy on hand functions in acute and sub acute stroke patients. The study revealed that with the use of different techniques moderate clinical progress can be expected in neurological disabilities after brain attack. Mirror therapy (MT) is a remedial intervention that improves and strengthens the movements of affected limbs. The study design was Pre test Post test single group study. Eleven samples with stroke were selected using convenience sampling technique. Samples were assigned for the pilot study. All the patients received Mirror Therapy. They were performing a variety of movements of the non paralysed upper limb and were observing in the box mirror along with routine treatment for a period of 4 days / week for four weeks. To assess the neurological outcome Fugl Meyer assessment and Wolf Motor Function test were used. Study results shown that there is a major positive change in both the assessment tool scores
at post intervention assessment was confirmed by WFMTWH score changed from 7.55 to 15.7 with a p value less than 0.0001 & FMAWH score changed from 34.18 to 47.36 with a p value less than 0.0002. Research answer proposes that “Mirror Therapy may be an effective interventional supplementation in the rehabilitative programme of patients with stroke. Mirror Therapy is cost effective intervention for motor revival of upper extremity in patients with stroke.”

Upper arm paralysis is one of the most overwhelming syndromes after brain attack. Fundamental researches had confirmed that post stroke inability for activities depend on the factors like extent of injury and phase of cortical stimulation by the exercise of affected hand. As motor injury regularly inhibits the dynamic use of the upper extremity for related activities, it leads to a reduction of its cortical condition. Thus, even when extremity practice is greater than before, resultant brain activation is restricted. As an option Mirror Therapy has been suggested as potentially useful.

In a pilot study by Altschuler with nine chronic stroke patients, reported the effects of Mirror Therapy on speed and accuracy of range of motion movement’s in patients with severe hemi paresis. In recent times, the benefit of Mirror Therapy in improvement of leg movements in acute and old stroke patients was shown in RCT with high quality studies. An imaging trial confirmed that when a right upper extremity is used but perceived as left upper extremity, may lead to an added conception of the right hemisphere and vice versa. As maximum recovery of damaged area of brain occurs within three months of post stroke period it is sensible to give Mirror Therapy within this window time (2009).

A study conducted by Harmsen WJ et.all (2015) on Mirror therapy is a prime method to recover motor function of the injured arm following stroke with the purpose to look into whether a ‘Mirror Therapy based Action Observation (AO) protocol’ enhance the improvement in neurological condition of the upper extremity after stroke injury. Thirty seven chronic patients with stroke were randomly assigned to action observation and control observation (CO) groups. Study samples were given instruction to do the task of reaching upper arm as fast and as easily as achievable. All samples were skilled for this with their paralysed arm alternated with either AO or CO. Study samples in the Action Observation group observed videotapes on Mirror therapy of ability to reach target actions done by their non paralysed arm, while samples in the Controlled Observation group observed motionless photographs of scenery. Post experimental effect was assessed by evaluating the prime outcome measure i.e. time taken for reaching target point. It is calculated by accelerometer.
Study results revealed that significantly decreased Movement time in both groups. But statistically it was lesser in action observation group than controlled observation group. This proved that Mirror therapy bsed action observation protocol is effective to mirror learning in post stroke patients. 54

Zult T et al (2016) conducted a study to prove that even though the exercise is done on one side of the muscle the effect can be seen on muscles of untrained side also. In this study 23 well fit adults were randomly assigned to mirror training and without mirror training i.e. 11 in mirror training group and 12 in without mirror training group. They were assigned to do 640 restricting strength of muscular constrictions of the right wrist flexors at eight percent Maximal voluntary contraction during fifteen series for three weeks. Peak level potency and definite Transcranial magnetic stimulation metrics of neural reaction, calculated in the mirror and no mirror groups at resting condition and during one-sided contractions at 60% Maximal Voluntary Contraction, were monitored during pre and post strength intervention. Investigators found that “observing the hand during exercise in a mirror can enhance the cross teaching effect. Use of Mirror therapy in future researches may speed up functional healing of destructed side of the body due to stroke”. 55

Christian D et al (2008) studied the effect of mirror therapy on recovery of severe stroke. According to study investigators rehabilitation of severely paralysed upper extremities after CVA is a main confront, particularly in the presence of sensory destruction. The aim of the study was to assess the outcome of Mirror Therapy to enhance activity of the affected hand with the healthy hand as early as possible after stroke. 36 stroke patients with severe hemi paresis of ischemic middle cerebral artery stroke were enrolled in the study. Study samples are divided in two groups i.e. control group and experimental group. According to study protocol mirror therapy was given for thirty minutes daily, five days / week for six weeks. Mirror therapy was not given to control group. The outcome was measured using Fugl Meyer scale for the upper extremity status. Samples also tested for usual function and neuropsychology. The result confirmed Mirror therapy patients able perform more distal function than patients in control group. Side of the lesion in hemisphere has no influence on this outcome. Mirror therapy stimulated improvement from hemi neglect. The researchers concluded that Mirror therapy
if started immediately after stroke is a hopeful intervention in recovery of sensory, attention and motor improvement.\textsuperscript{56}

Ching. Y. et al (2013) conducted a study to assess the effect of Mirror therapy on motor and sensory recovery in chronic stroke patients. They compared the effect of Mirror therapy with control treatment on activity performance such as ADL and sensory functions of chronic stroke patients. The study design selected was Single blinded, randomized controlled trial. settings of the study - four hospitals in Taiwan. Study samples were patients coming to OPD with old stroke problems like mild to moderate motor injury. Sixteen patients in Mirror Therapy group received Mirror therapy for upper extremity. The control treatment group are taught to perform some task which can be performed by using upper extremity. Treatment of both the groups was for $1\frac{1}{2}$ hours per day for 5 days in a week till 4 weeks. Outcome was measured using the Fugl Meyer estimation; kinaesthetic variables to assess gate speed, reaction time, standardize movement time, tools. Results showed that the Mirror Therapy group performance was better in the overall and the distal part Fugl Meyer estimation scores demonstrated shorter reaction time. On the basis of the findings the researchers conclude that application of mirror therapy is beneficial on movement performance, motor control and sensing temperature but may not be effective in daily routine functions.\textsuperscript{57}

Thieme H et al (2013) have reviewed the studies on use of Mirror Therapy to improve motor function after stroke attack. Their study objectives were to sum up the efficiency of MT on recovery functions related to motor activity, ADL, pain and unilateral neglect in patients with stroke. The reviewers included Randomized Controlled Trials & randomized cross over trials comparing Mirror Therapy with any type of controlled involvement for stroke patients. Researchers included fourteen research studies. The total participants in 14 studies were 567. When evaluated with all other treatments, Mirror Therapy has a notable positive outcome on motor activity of the samples. With a $p$ value less than 0.05. ADL was also influenced by Mirror Therapy. Authors found remarkable positive effect on pain with $P = 0.03$. They found inadequate proof for recovery of visuospatial neglect with a $p$ value of 0.01. Motor functions were stable during follow up evaluation after six months. Researchers concluded about review study that ‘the results support for the efficacy of Mirror therapy in improving affected hand motor functions, ADL & pain as an additional treatment to usual physiotherapy treatment for stroke patients’.\textsuperscript{58}
A study conducted by Gunes, Y. Et al (2008) to assess the effects of Mirror therapy on recovery of movements, unusual tightness and functions related to hands of patients admitted with sub acute stroke. The study was a Randomized Controlled, Assessor Blinded, conducted for four weeks, and follow-up after six months. The study was conducted in Rehabilitation Education and Research Hospital. Forty patients admitted with stroke with an average group of 65 years were included in the study. MT was given for 30 minutes to 1st experimental group and mirror treatment with some different activities to 2nd experimental group and usual physiotherapy treatment to control group was given for five days a week for 2 to 5 hours a day up to four weeks. The usual physiotherapy program was according to the need of the patient and consists of activities related to neurological development, occupational therapy, and speech treatment. At the same time both the mirror groups was given an added thirty minutes of Mirror treatment. The result was measured using BSMR (Brunnstrom stages of motor recovery). Hand spasticity was assessed by MAS (Modified Ashworth Scale). The study result scores show that there were no considerable differences between the groups for the Modified Ashworth Scale. Authors concluded that there was improvement in upper extremity functioning for some extent but no considerable improvement was observed in 1st experimental group who had received Mirror Therapy according to fixed protocol. It was a better score compared to 2nd mirror treatment group and with a control treatment.  

**LITERATURE RELATED TO OLFACTORY STIMULATION**

Oils extracted from plant origins were one of the most precious inventions done by our ancestors. These oils were used for therapeutic purposes in all over the world by the Crusaders during medieval period before the days of medicines and the production of beauty creams in laboratory. The term Aromatherapy was used by the French chemist, Rene Maurie Gatefosse in nineteenth century. He used lavender oil local application to treat his burn wound on his hand. He noticed that the healing of the wound was very fast without any complication. Then he started testing the oil for other therapeutic qualities. Thus in France Aromatherapy became fastest growing Natural remedial arts. It has also quickly achieved admiration from traditional health practitioners. Aromatherapy is being used more in gyms, fitness centres and beauty clinics and Ayurvedic clinics, hospice centres, and surgical homes.
The oils which spread smell are usually extremely volatile in nature. Because of this volatile nature they distribute all the way through the skin in the same manner like other gases. They possess the ability to shatter right into the deep layers of the skin and pass to different body organs, tissues, and glands of the body. When the oil pass through skin layers it leaks into blood capillaries of the skin layer and are spread inside the body parts. When we take breath in the presence of this oil, odour molecules are taken directly to the roof of the nose, where information regarding the particular smell, is sent to brain region related with odour. Most of the essential oils are antiseptic in nature. Some oils are efficient in combating with viral & fungal diseases. Some oils have the effect of anti inflammatory. Some particular essential oils enhance blood circulation and there by improve cell regeneration. Some of the essential oils enhance relaxing effect and also are good stimulating agents. Ms Paula has conducted few research studies to assess the effect of this essential oil.

First case study – a man with age 86 years had left MCA infarct. He had right sided hemi paresis, dysphagia, facial grimaces. After receiving ten episodes of aromatherapy, facial massage using lavender oil flaccidity of face was decreased. His had improved tone in his cheeks, under the chin and tongue. His swallowing mechanism was improved. He was able to swallow full amount in the mouth. Further more he was able to have soft diet able to drink fluid without much difficulty.

Second case study – an eighty-eight year old lady had left cerebral infarct. She had right sided weakness and was unable to speak, had right side neglect. She had the history of previous stroke and hypertension. She was assigned for face massage for eight days with lavender oil and mandarin essential oil. After receiving the aroma therapy the patient had reduced dribbling/drooling of saliva. She was able to bring her lips close together while swallowing and was able to wipe her oral cavity with her lips when needed to clean any unnecessary spillage on her lips.

Third case study - A lady with left cerebral infarct and right sided weakness, with the history of Myocardial Infarction was admitted in Linda’s clinic for treatment. She had difficulty in swallowing; her cheeks were lacking firmness and hanging limply, and unclear articulation of speech. After receiving eleven course of aromatherapy, massage therapy with lavender oil the she was able to speak using more comprehensible, unprompted words, though she is lacking co-ordination and movement.

Though the above study findings were statistically not proven cases were studied closely and improvements were observed after interventions by researcher.
Many Researchers had used Lavender fragrance in their research studies as it has variety of therapeutic and curative properties. There are also evidences to prove that lavender oil is effective in treatment of several neurological disorders. A number of research studies on animal and on human beings recommend that lavender contains properties of anti-anxiolytic, mood swing stabilizer, relaxing, pain-relieving, and antiepileptic and neuro-protective. These research studies increased the chances of revitalization of lavender remedial usefulness in neurological problems. A study was conducted by Vinay Sayorvan (2012) to explore the effect of lavender oil inhalation on CNS, Autonomic NS, and temper responses in human beings. 20 samples who are willingly ready to participate in the study with good physical health involved in his trial. Researcher studied ANS Parameters i.e. BP, Pulse, respiration, and temperature to find out provocation of the ANS. Investigator also asked study samples to calculate approximately their mood responses such as feeling pleasurable, relaxing, sensuality, recreation, etc to assess individual behavioural provocation. Electroencephalogram (EEG) was done from thirty one electrodes on the scalp. Data analysis was done to evaluate the effects of lavender oil on physiological and psychological conditions. The results revealed that lavender smell significantly reduce of BP, Pulse, and body temperature, which point out relaxation of autonomic provocation. In conditions of temper reaction, the samples who have received lavender oil inhalation were segregated as very active, fresh, and comfortable than the samples with base oil inhalation. This shows that lavender oil is more effective than base oil in improving the power of theta and alpha cerebral functions. The topographic graph demonstrates clearly additional dispersal energy in alpha range emission in both the sides of temporal and middle region. The study result proves the soothing effect of inhaling lavender oil.

Research findings published in an article in Daily Herald (2016) state that ‘Lavender smell could improve memory’. The article summarizes that some aroma can have intense effect on our memory & cognition particularly aroma of lavender. In treatment with aroma, plant extracts and the oils of certain plants were used to straighten the immune system, speed up healing, for better memory & cognition, relieve depression and anxiety and to induce sleep. A study conducted by the employees of Oregon Health & Science University and available in the Journal of Complementary and Alternative Medicine, confirmed that the lavender oil considerably enhances the memory after a difficult standardized test. In this study ninety-two people were divided into 3 groups. First group with lavender essential oil, 2nd group with placebo coconut oil and a third group water group. Two added set of people
were studied to assess the psychological outcome of essential oils. The closing results confirmed major enhancement in the lavender group (1st group) over the placebo (2nd group) and water only groups (3rd) for memory after the difficult standardized test. Remaining data of this study also confirmed that lavender oil was truly decreased the sense of stress about test. The study confirmed that there is both psychological and physiological benefit of lavender on brain.  

J Altern (2007) conducted a study with an objective to determine the effect of combination of aromatherapy and acupressure against only acupressure in improving shoulder pain and motor power of patients with hemiplegia. Fifteen samples were assigned randomly in each group i.e. to aromatherapy acupressure group and only acupressure group. Aromatherapy acupressure group used lavender, rosemary, & peppermint for their therapy. One acupressure sitting lasted for 20 minutes and was executed 2 times /day for 14 days. Shoulder pain & motor control were assessed. Pain score in both the group were considerably decreased after treatment, compared with pre-treatment status. Both groups - p values were < 0.001. There was significant improvement in motor power after treatment, compared to pre-treatment status in both groups. The p values of both the groups were < 0.005. These results propose that if acupressure is given with aromatherapy, the effects are better than giving only acupressure in hemiplegic shoulder pain in stroke patients.  

A review study was conducted by Dalinda IS et al. (2017) on the Effectiveness of Aromatherapy for Depressive Symptoms. According to the researchers Depression is one of the fast growing mental health problem which affect more than 350 million people all over the world. Aromatherapy is an accepted CAM (Complementary and Alternative Medicine) intervention selected by people with depressive syndromes. Due to the increasing demand of aromatherapy to cure depression, more evidence based studies are needs to be done urgently on this topic. Author’s main purpose of this review study was to present an investigation which was proved scientifically on the effectiveness of aromatherapy on depression with any kind of patients. A methodical database search was done by the authors using per decided search terms in five databases. Those are AMED, CINHAL, CCRCT, MEDLINE, and PsycINFO. 12 RCTs and 2 methods to administer aromatherapy treatment were included to measure Outcome of this review study. Among 12 RCTs five studies with inhaled aromatherapy, seven studies of massage aromatherapy. It is observed that improvement was seen in 7 studies related to depression. More than half study quality included in review was not up to the mark and there was considerable variation in
interventional protocol. Different assessment tools were used in the study which is also an added point for variation in result. Still the study result proved that Aromatherapy has confirmed positive effect to relieve depression and can be used widely in conjunction with routine treatment to relieve depression. Predominantly Aromatherapy Massage has more positive effects than Inhalation Aromatherapy.  

**LITERATURE RELATED TO GUSTATORY STIMULATION**

Swallowing dysfunction and disability is seen very commonly after acute cerebral stroke. The impact of this problem and its prognosis is very uncertain. Patients may face this problem for longer period of time or may get rid of this problem early. Many times because of problem the aspirate food content and suffer from aspiration pneumonia, which may prolong their hospital stay. Mann G et al (1999) aimed to conduct a prospective study to assess the improvement of swallowing activity after first six months of stroke. Researchers planed to discover the main independent clinical and video fluoroscopic improving aspects linked with an increased danger of swallowing problem and its complications. They prospectively collected a beginning unit of 128 patients referred to hospital with stroke. They observed swallowing action clinically and video fluoroscopically, for an average of three and ten days from the onset of stroke. All samples were observed prospectively for six months, and observed for the complications like death, stroke recurrence, respiratory complications, improved swallowing activity & back to routine diet.

Swallowing defect was noticed clinically in sixty five stroke patients and video fluoroscopically in eighty two clients. During six months period, 26 stroke patients had chest infection. Out of 112 patients 97 patients survived and returned to usual stroke diet. Clinical proof of a swallowing defect was there in 56 stroke patients. Video fluoroscopy was done after 6 months for 67 stroke patients who had swallowing defect at the beginning. During fluoroscopy it was found that 34 patients had penetration of the false cords in and aspiration problem in seventeen patients. The single reason predicted and detected for chest infection was either delayed or absence of swallowing reflex. Delayed oral transit was the single reason to failure of the client to return to have a normal diet. The cause for over all outcome failure was seen in a single client with multiple post stroke problems in a male client with 70 years of age. Authors conclude that swallowing needs to be observed in all acute stroke victims, as dysphagia is very commonly seen in all the patients. Even though
the above mentioned study is directly not related to gustatory stimulation it throws light on the importance of gustatory stimulation.

Japanese believe that rubbing ice on anterior part of the neck just before feeding helps for easy swallowing of dry food, enhance swallowing movement, improve apraxia, initiate swallowing action. They use this technique to train the patients for easy swallowing. In a crossover study was conducted by Nakamura T, et al (2013) on” usefulness of ice massage for eliciting the swallowing response”. They selected twenty four stroke patients with dysphagia and with other cerebrovascular disease. They observed and measured the hold of patient on dry swallowing and the initiation of the swallowing reflex by video fluoroscopic testing, with ice application and without ice rub on anterior neck. They recorded all the four trials done for swallowing movements and efforts. They also counted how many times the patients are able to swallow with ice rub or without ice rub. The results suggest that "ice massage considerably decreased the latency to initiate and enhance swallowing reflex and able to initiate swallowing even in persons who could not swallow with no message. These findings reveal that application of ice on anterior neck region has an instant outcome on starting of the swallow reflex. Thus, ice rub could turn on the damaged supranuclear area, normal nuclear area and sub nuclear territory for swallowing. Use Ice rub on anterior neck area has confirmed to be helpful in many clinical training sessions on swallowing difficulties.67

Rosenbek JC et al (1996) conducted a study with mainly two purposes i.e. 1st to collect a data measured with objectivity related to the time taken by stroke patients disphagia to swallow the food contents. The 2nd was to test the effects of the thermal application for short term on these same durational measures. This study with cross over design observed ten episodes of time taken for swallowing with thermal application and without thermal application with each stroke subject with dysphagia. Two findings emerged from their study one was ‘time taken for swallowing in twenty two patients of stroke with dysphagia were significantly different among them and have distributions that were abnormal with heterogeneous variances’. The 2nd finding was ‘thermal treatment decreased the period of transition phase and total duration of consumption’.68

Logemann JA et al (1995) conducted a study to assess the effects of sour bolus food as oropharengeal swallowing measure in patients with neurogenic dysphagia. This study aimed to see the effects of sour bolus of lemon juice with 50% concentration, and barium liquid of 50% while passing through pharynx. Samples with neurogenic disphagia were
selected and made two groups. First group had nineteen patients with stroke attack. Second group had eight patients with dysphagia due to other neurological disorders. Samples were selected on the bases that they had shown the signs of delay in swallowing of 1ml and 3ml of liquid barium during video fluoroscopy. Outcome revealed that notable improvement was seen with the sour as compared to non sour bolus swallowing. The study result confirmed that there was improvement in time taken for the beginning of oral swallow in both sample groups, a considerable decrease in delay of pharyngeal swallow in first group of patients and in the occurrence of aspiration in second Group of patients. Particular swallow methods in both sample group also were better with the sour bolus. Effects of quantity of the liquid were there but not as constant as in previous studies. So study confirms that there was significant improvement in onset of swallow in oral cavity of a sour bolus in both the groups. In group I there was reduction in pharyngeal swallow time and frequency of aspiration is reduced in 2nd group with the sour as compared to non sour boluses.

Bisch EM et al (1994) conducted a comparative study to assess how the viscosity, volume and temperature of bolus food affect the pharyngeal swallowing effect in patients having dysphagia due to neurologic impairment and in normal patents. The oropharyngeal swallow of ten patients with mild dysphagia after three weeks of CVA (stroke), ten normal samples, and eight samples with neurological impairment having modest to severe difficulty with swallowing were observed video fluorgraphically, to inspect the effects of bolus with two different temperatures i.e. with current room temperature and 33°F, with two volumes, and two different viscosities, during the period of pharyngeal point swallow actions. Researchers observed the rate of recurrence & type of oropharangeal swallowing trouble and bolus passing. Normal patients showed considerably longer pharyngeal reaction period and longer time period for closure and opening of the upper oesophageal sphincter only for 1 ml cold liquid. The samples with stroke and the eight patients with neurological impairment with considerably dysphagic, displayed few important effects of temperature on swallowing problems. Increase in bolus amount and thickness brought down pharyngeal elevation delay time in both groups with neurological impairment i.e. difficulty in swallowing. Patients with Stroke showed longer pharyngeal delay time but shorter pharyngeal reaction times, laryngeal shutting, & closing and opening time of the oesophageal upper sphincter, than normal samples on fixed bolus amount and thickness of liquid.

Cola PC et al (2010) conducted a research study to see the cold and sour food influence pharyngeal transit time of stroke patients. Thirty adults (16 male and 14 female)
with post stroke period from 1 to 30 days, practicing right hand for Activities of Daily Living, between the age group of 41 to 88 years were selected for the study. A video fluoroscopy swallow test was performed to analyze the pharyngeal transit time. Each patient’s swallowing mechanism is observed with 5 ml paste bolus, of four different taste and temperature (natural, cold, sour & cold sour) one at a time given by spoon. Normal was with 22°C and cold with 8°C were used for trial. Specific statistical software was used to calculate transit time of bolus during pharyngeal phase was measured. Result shows that the time taken for pharyngeal transit was considerably less while swallowing cold sour bolus compared to other stimuli. So the study concludes that cold and sour taste cause a notable change in swallowing pattern, by decreasing the transit time at pharyngeal region. The result may help to bring positive changes in attitude of CVA patients having difficulty in swallowing.71

Gatto AR et al (2013) conducted a study to find out the effect of sour and cold food on oral transit time during swallowing in patients with stroke. Fifty two ischemic stroke patients (28 male & 24 female) between age group 50 to 80 years, having hemiplegia of any side with mild or moderate pharyngeal difficulty in swallowing were selected and included in the study. Video fluoroscopy was done to observe the time taken for swallowing. Each sample was studied throughout swallowing period of of 5 ml bolus food with consistency of paste. Researchers used four different stimuli natural, cold, sour and sour-cold. The study result proved that the cold sour drink stimuli can cause notable decrease in time required for oral transit of food and total oral transit time. So investigators conclude that sour flavour with cold temperature decrease oral transit time in patients with stroke.72

**LITERATURE RELATED TO THE TACTILE STIMULATION**

A literature review by Geoffrey C from UK writes in his article that “Massage is generally seen as a remedial art without scientific groundwork and further systematic study is certainly needed”. His article reviews the physiological and healing effects of massage. Therapists who are training and taking care of sports people always bothered to enhance healing, re-establish regular function after injury and try to attain best possible performance from their players. Massage can help out with all of these processes by influencing arterial blood flow, venous return, clotting of the blood, tissue swelling, lymphatic drainage, connective tissue and muscular tissues. The nervous system is also affected with reference to pain and relaxation. superficial blood vessels are dilated by massage of that area and
Enhance blood flow. The local vascular reaction is generally due to release of histamine, and improved venous return due to improved stroke volume. Improved blood flow due to massage improves the performance of fatigued muscle. Muscle fibers getting massage have decreased spasm, improved strength of contraction and improved stamina compared with muscle without massage.

Massage with certain techniques enhances blood to flow more efficiently than others. Even if the massage is given to one limb only, blood flow increases in other limb also. This will help to increase the blood flow of injured limb where it is not possible to give direct massage. Many experiments have proven that effleurage massage technique is one of the lightest massage techniques, considerably increase blood flow than shortwave diathermy & therapeutic ultrasound. Once effleurage is stopped there will be decrease in blood flow and will become normal within two minutes. Stroke patients having flaccid paralysis of a limb will get benefited in same way which indicates that the effect on flaccid limb is not entirely depend on spinal reflexes. Massage will help in prevention of denervated muscle tissue conditions in stroke patients which can result in loss of muscle bulk and contractile capacity. Effleurage and petrissage for 10 minutes daily for one month can prevent Denervated muscle.73

Ning et al conducted a study to find out the therapeutic effects of massage and acupressure on shoulder and hand syndrome in patients with hemiplegia. 120 patients with hemiplegic having 1st stage shoulder hand syndrome were selected and assigned randomly in two groups. 1st group was given electric acupuncture with a fixed protocol and massage and 2nd group was receiving usual rehabilitation therapy for six weeks. Pain in shoulder joint after some movement was observed using numerical pain scale. Assessed focused movement of the hand, using modified Rankin Scale.

During follow up visit after twelve week of intervention, it is observed that pain score, number of clients with stage II and III shoulder-hand syndrome condition, and Modified Rankin Scale score all were better in the acupuncture-massage clients than with the rehabilitation group with a p value less than 0.05. Functional movement during ADL of hand has also shown improvement in acupuncture--massage samples compared with clients in rehabilitation group with a p value less than 0.05. Investigators conclude that acupuncture-massage with a fixed protocol may have healing property on ‘shoulder-hand syndrome’ in patients with hemiplegia.74
According to Lamas K et al (2015) “even after providing excellent quality care, reduced sensorimotor activity, uneasiness & pain were seen in patients with stroke for at least one year”. This may cause negative changes in health and increased dependency which is directly responsible for increased expenses on health. Many researches have confirmed Touch massage reduces anxiety and pain which helps in improving quality of life. Somatosensory area Stimulation can enhance activities of sensorimotor organ. On the bases of this findings we can believe Touch Massage could enhance independence in post stroke conditions. Lamas K et al have planned to conduct a comparative study to evaluate effects of Touch Massage in patients suffering from stroke with sham treatment. The study is still in process.

Thanakiatpinyo T et al (2014) conducted a study to compare the effect of traditional thai massage and conventional physical therapy programs in treating muscle spasticity, functional ability, anxiety, depression, and QOL in patients with CVA. The researchers included fifty strokes patients having spasticity in elbow or knee muscles. They all were selected from OPD having muscle spasticity grade ≥ 1+ assessed by modified Ashworth scale, with an age group 50 years and above, and were able to interact. 24 patients were randomly assigned to interventional group, receiving Traditional Thai Massage and the control group with twenty six patients receiving usual physiotherapy program. Both groups received treatment as decided for two times per week for six week. Spasticity position, capacity to function, quality of life, anxiety and depression were assessed in pre assessment and then after Six Weeks. The study findings revealed that the number of patients whose Modified Ashworth Scale score had come down by one grade which has no statistical significance of difference between the groups. Both Traditional thai massage and Physiotherapy groups showed a considerable improvement in functional ability & quality of life. Anxiety & depression scores were improved in the traditional thai group. So study reveals that there is no strong statistical proof to explain TTM is a better option than PT program in improving patient condition with spasticity. But it was found that even tough there is no difference between effects of two therapies, it is found that both the therapies had helped to improve patient’s condition and hence both the therapies are found to be effective in relieving spasticity, enhance functional capacity, and improve quality of life. Only TTM is effective in reducing anxiety & depression in stroke patients.

Zhang XL and et al (2013) aimed to explore the optimized rehabilitation program in the treatment of post-stroke hemiplegia at the recovery stage. They randomly selected 60
patients and were randomized into a rehabilitation + massage group (group A) and a rehabilitation + acupuncture group (group B), 30 cases in each one. Both sports therapy and functional training were adopted in the two groups. In the group A, the massage therapy was added. The rolling method and palm-rubbing method were used on the affected side, the pressing, kneading and plucking methods were applied to on the acu points; and the nipping method was adopted at the twelve Jing-well points. In the group B, acupuncture was applied to other acu points. The treatment was given once a day, 5 treatments a week in the two groups. The efficacy was evaluated in 3 weeks. Fugl-Meyer scale, Barthel index (BI) score, modified Rankin Scale and stroke specific quality of life were used to assess the limb motor function, the activity of daily life (ADL), independent activity of life and the QOL of patients in two groups before and after treatment. Based on the total cost and benefit, the health economics evaluation was conducted in the patients of the two groups. The treatments all improved the limb motor function. The differences in all the indices were significant statistically before & after treatment both the groups p values were less than 0.05. All indices after treatment were not different obviously between the two groups and p values were less than 0.05. In terms of health economics, the expense was decreased by RMB 688.48 while BI was increased by every 5 scores in group A in comparison with the group B. The study concludes that both the rehabilitation and massage therapy and the rehabilitation and acupuncture therapy improve the motor function of the limb and QOL in patients with post stroke hemiplegia. The therapeutic efficacies are similar between the two therapeutic programs. The program of rehabilitation and massage is more economical in the aspects of ADL improvement, being advantageous at simple operation and low cost.

Sibbritt D. et al (2012) conducted a study with an objective of using Thai massage, herbal treatment and usual PT could improve ADL, severity of pain, mind set & sleep patterns of patients with stroke over a time period. The study was conducted over a 3 month period of time. Patients were selected from a 42 bed physiotherapy centre where mainly stroke patients but also head injury and spinal patients were seeking admission for rehabilitation treatment. Sixty two patients were included, out of which 29 were male patients. Average age of samples was 59 years. Out of them 63 percent patients were married. The average post stroke time was fifteen months since attack. Pre status average Barthel Index score was 50.7. The average score of emotion, pain & sleep were 2.6, 3.1, & 3.2, correspondingly. The Barthel Index considerably improved by 6.1 points after one month with a p value less than 0.01, after three months the score was 14.2 points having p
value less than 0.01. After one month emotion score considerably improved by 0.7 points having p value less than 0.01 and after three months improved to 0.9 points having p value less than 0.01. After one month pain score considerably decreased by 0.5 points having p value less than 0.01 and after three months also the pain score decreased by 0.5 points with a p value less than 0.01. After one month a considerable improvement was seen in sleep score by 0.5 points with a p value less than 0.01 and after three months by 0.6 points with a p value less than 0.01. so the study concludes that this specific Stroke Rehabilitation Program has helped to improve ADL, pain, sleep patterns and mood considerably in stroke patients. This result makes the researchers to think of conducting more studies with specific intervention along with routine rehabilitation programme for stroke patients.

A study by Esther M et all (2004) conducted a study to assess effect of back massages with slow stroke technique on anxiety level and shoulder pain in stroke patients admitted in hospitals. The study approach is quantitative approach, and study design experimental pre-test- post-test control group design. Self-reported scores of anxiety, pain, BP, and HR of both control and experimental groups were assessed before, immediately after, & after three days of the intervention. SSBM was given for 10 minutes daily for seven days at a fixed time. 102 patients participated in the study. They were randomly assigned to message group and to control group. Results revealed that the massage with SSBM considerably decreased the patient’s pain score and anxiety score. Even positive changes are seen in both systolic and diastolic BP and HR which indicates relaxation of mind and body. The long term effect of SSBM was seen which was evidenced by the maintenance of the physiological and psychological parameters even after 3 days of intervention of SSBM. Even patients perceive that SSBM improve and maintain physical and psychological parameters. From the study result authors propose that slow stroke massage technique is useful as efficient nursing action for decreasing pain in shoulder and anxiety in elderly stroke patients.

According to Mina J. (2010) including complementary treatment such as massage therapy (which is considered as an important nursing intervention) with routine treatment of stroke patients can help to decrease the difficulties faced by them. She conducted a study with an aim to assess the effect of massage on level of blood pressure and anxiety level of patients with stroke. Study approach was quantitative approach; study design Quasi Experimental Pre Test Post Test Control Group Design with two steps. 50 CVA patients were selected using conventional method of sampling technique. Inclusion criterias were
documented patients diagnosed as CVA, able to speak, fully consciousness, admitted since one week and are willing to participate in the study were included in the study. In experimental group, massage technique was taught to relatives seven times per day and confirmed that they are using a proper technique for massage and then next day onwards they were allowed to do independently. Samples in control group were given only the usual treatment and rehabilitation. Anxiety level by using Cattle test and BP for were evaluated prier to massage and on the last day of the study. Study result shows that mean BP and Anxiety score in massage group had been reduced at the end of study with a p value less than 0.05 but there was no considerable difference. So study concludes that massage is useful to decrease blood pressure and level of anxiety. Therefore massage can be used as an added therapy along with the routine management of stroke. 80

Kang et al (2007) conducted a study with a purpose to assess the effects of two types of massages i.e. meridian and hand massages on paralysed upper extremity of patients suffered cerebral stroke. Study was conducted using non-equivalent & non-synchronized control group design. Sample in the study were stroke patients admitted in medical centre. There were three groups in the study first experimental group with twenty eight samples, 2nd experimental group with 28 samples and a control group with 28 samples. 1st experimental group received meridian massage for ten minutes daily for two weeks with routine treatment, 2nd experimental group had hand massage for two and half minutes daily for two weeks with routine treatment. No intervention was given for control group except routine treatment. Dependent variables were grip power, shoulder pain, oedema, Range Of Motion of upper extremity, ADL & depression level. Study results depicted that score for hand function and ADL were considerably improved in 1st group who had meridian massage compared to 2nd group who had hand massage & control group who had only routine treatment. 1st group had less depression than 2nd and control group. Researchers conclude that to improve hand function and ADL meridian massage can be included with routine nursing care of patients with CVA. It also helps in prevention of depression in stroke patients. 81

**SUMMARY**

Number of evidence in literature is available which mentions application of various stimulations which can be used in stroke rehabilitation to improve neurological status of the patients. Researches proven that multi sensory stimulations are more effective than stimulating a single sense. The literature review depict that findings from preceding studies
support the significance of non pharmacological methods like massage, mirror therapy, musical stimulations provides a good support to ongoing treatment. In many reviews it is mentioned that more studies needs to be conducted to support their studies. The review of literature given information regarding the easier tools available which can be used to assess neurological status. These reviews encouraged researcher to include all five sensory stimulations in her study.