

POTENTIAL MUSIC THERAPY MODEL FOR STROKE REHABILITATION BASED ON ĀYURVEDIC PRINCIPLE

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Abstract: A powerful tool, music has the capacity to affect a person's emotional, behavioral, mental, and physical health. New studies reveal that music has an impact on humans on many levels, from the most overt to the most subliminal. As a result, in addition to being used for entertainment, music can also be therapeutic. Numerous studies have already used music as a therapeutic technique. There hasn't been a thorough investigation of the type and approach of music that is beneficial for the neurological condition of stroke rehabilitation, though. However, complementary treatments like yoga and music therapy can help manage the condition and lessen symptoms. We developed a music-based approach that combines yoga to improve the quality of life for people in stroke rehabilitation. One form of Mind-Body Medicine therapeutic strategy is music therapy.

The goal of the ancient science of ayurveda is to balance a person's dosha, or biological constitution, and psychological make-up in addition to preventing and treating disease. Indian music, or Ragas, aids in altering thought patterns by encouraging pleasant emotions while fending off negative ones. We've created a collection of ragas using biorhythm theory and basic Ayurvedic concepts to produce the best raga for the condition.

Keywords: Stroke rehabilitation; Music therapy; Quality of Life; Rāgās; Ayurveda; Music; Yoga

INTRODUCTION

The World Health Organization (WHO) defines health in a modified way as having environmental harmony as well as the capacity and ability to pursue one's spirituality (Nuku et al., 2016).

In Ayurveda, health is referred to as *swasthya*. In the *Suśruta Saṃhitā*, *Suśruta* says that a human is considered to be in a healthy state when their humor, enzymes, metabolites, tissue system, excretory functions, ecstasy, soul, sensory organs, and mind are all in balance (Atrideva, Bhaskar Govindji Ghanekar, 2007). According to *Āyurveda*, the human body is made up of the *Doṣas* (*Vāta*, *Pitta*, and *Kapha*), psychic elements (*Sattva*, *Rajas*, and *Tamas*), *Dhātu*, and *Malā*. *Vāta*, *Pitta*, and *Kapha* are symbolized by wind, fire, and water, respectively (Mishra, 2003). Psychological elements called *Sattva*, *Rajas*, and *Tamas*, respectively, duplicate equilibrium, vitality, and sluggish personality qualities. The irregularity or vitiation of *Vāta*, *Pitta*, and *Kapha* is the primary factor in the causation of disease (David Frawley, 1999).

A series of guidelines must be followed to live a life that is healthy according to *Āyurveda*, the science of life (Sandeep, Gajanan, & Rajendra, 2013). These three elements—*Ahāra* (dietary practices), *Nidra* (sleep), and *Brahmacarya* (celibacy)—are referred to as the three *Upastambha* (supporting pillars) that are

STROKE

Stroke causes an estimated 5.54 million deaths worldwide each year. The main burden of stroke to individuals and societies is a leading cause of disability—about 40% of stroke survivors are left with some degree of functional impairment (Young & Forster, 2007). Stroke is the sudden death of some brain cells due to lack of oxygen when the blood flow to the brain is lost by blockage or rupture of an artery to the brain (Rajesh Jain, K. S. Girhepunje, 2017). The World Health

Organization defines stroke as “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin” (Obinson, 2000). Rehabilitation is a complex set of processes usually involving several professional disciplines and aimed at improving the quality of life for people facing daily living difficulties caused by chronic disease (Young & Forster, 2007). Recent studies have concluded that neuropsychiatric complications (i.e., emotional, behavioral, and cognitive disorders) may have a negative effect not only on the social functioning and overall quality of life of stroke survivors but also on the recovery of their motor functioning, as well (Obinson, 2000).

In Ayurveda the word stroke can be interrelated with *pakshaghata* (Rajesh Jain, K. S. Girhepunje, 2017). Pakshaghata is a disabling Vata vyadhi and enlisted among the eighty Nanatmaja vata rogas. The term Pakshaghata is made up of two words; ‘Paksha’ i.e. either side of the body and ‘Aghata’ denotes a blow or severe destruction caused which is due to the impairment of the sensory and motor system and its controller i.e. the brain. Hence, Pakshaghata is a condition that affects half part of the body (Adil Rais, Prasher, & Anup B Thakar, 2019). All *Acharyas* have emphasized in their *Samhitas* that *Vāta* is the predominant dosha in the manifestation of this disease. Even though the association of pitta and kapha may be found, the main causative factor is *Vāta* (Rajesh Jain, K. S. Girhepunje, 2017).

The two main reasons for cerebrovascular accidents are infarction and hemorrhage which can be considered as *Avarajanya* and *Dhatukshaya* in Ayurveda respectively. According to *Sadhyasadyathana nidana*:

शुधवतहतम् पक्शं कुछसाध्यतमं विदुः । साध्यमन्येन संस्रत्साध्यं कस्जयहेतुकं ॥

TYPES OF STROKE

ISCHEMIC STROKE

The most prevalent type of stroke is an ischemic stroke. This happens when a blood vessel in the neck or brain is stopped (Wallace, 2016). The blockage may result from "the development of a clot within a blood vessel of the brain or neck, the transfer of a clot from another area of the body to the brain, such as the heart; or a severe constriction of an artery in or leading to the brain (Randolph, 2016).

Cerebral infarction is the main ischemic stroke lesion. If cerebral tissue does not receive enough blood, there will first be a temporary loss of tissue function and, given enough time, an infarction with the subsequent death of neurons and supporting structures. Ischemia triggers a series of processes that start with the loss of electrical function, continue with the disruption of membrane function brought on by calcium influx, produce calcium-dependent excitotoxicity, produce reactive oxygen species, and eventually result in the lysis of cells (Feske, 2021).

HEMORRHAGIC STROKE

Hemorrhagic stroke is caused due to bleeding into the brain by the rupture of a blood vessel. Subarachnoid hemorrhage (SAH) and intracerebral hemorrhage (ICH) are additional categories for hemorrhagic stroke (SAH). Stroke caused by haemorrhage is known to have high death rates and significant morbidity. A worse prognosis is linked to hemorrhagic stroke progression (Feske, 2021).

Intracerebral bleeding results from cerebral vascular rupture, which frequently happens as a result of hypertension. When cerebral vessels rupture due to ICH, atherosclerosis, aneurysms, or arteriovenous malformations that have already damaged the arterial walls of the blood vessels are frequently to blame (Perna & Temple, 2015).

REASONS FOR THESE CONDITIONS

Risk factors for this condition can be hypertension, elevated lipids and diabetes, and so on. Risks due to lifestyle factors can also be addressed like smoking, low physical activity levels, unhealthy diet and abdominal obesity (Obinson, 2000). Some of the other causes for stroke can be silent brain infarction, a history of diabetes, a higher degree of stenosis; history of myocardial infarction, or angina (Omenico I Nzitari , M Ichael E Liasziw , Peter G Ates , Brenda L. S Harpe , R Ichard K.T. C Han , H Eather E. M Eldrum, 2022), atherosclerosis, emboli of cardiac origin, arterial dissection (JulienBogousslavsky, 1992), immunological disorders and migraine (Martin, Enevoldson, & Humphrey, 1997).

Pakshaghata is one of the eighty Nanatmaj *Vāta* Vikaras mentioned. *Vāta* is the major dosha in the manifestation of various diseases, as emphasized by all Acharyas in their Samhitas. Although there may be an association of pitta and kapha, *Vāta* is the primary underlying cause (Rajesh Jain, K. S. Girhepunje, 2017). *Pakshaghata* occurs due to movement of vitiated Vata through various blood vessels traversing Urdhvagami, Adhogami, and Tiryakgami (~upwards, downwards or in both directions) throughout the body. Sira (~vein) and Snayu (~nerve) which are responsible for coordinating motor movements causes vitiation of Vayu in half part of the body, may lead to loss of sensory and motor function. Prana vayu resides in the cephalic region, which is the place of all Indriyas. Hence, due to Vata prakopa (~vitiating of Vayu), functions in half part of the body get diminished, weakness in the upper limb and lower limb, slurred speech⁶, and sometimes loss of control over defecation and urination (Adil Rais, Prasher, & Anup B Thakar, 2019).

RISK FACTORS FOR ISCHEMIC STROKE AND HEMORRHAGIC STROKE

Many stroke risk factors have been identified through epidemiologic investigations. Hereditary variables, for example, are some of these that cannot be modified but are crucial in accurately identifying those who are at high risk. These include Age, Race, Sex Family history of stroke, etc. Lifestyle-related and environmental factors may usually be altered or managed using tried-and-true methods based on randomized clinical studies. These can be Hypertension, Diabetes, Smoking, and Atrial fibrillation (Richard Arbour, RN, MSN, CCRN, CNRN; Karen March, RN, MN, CCRN, 2005). Diabetes mellitus, smoking, and alcohol show risk for HS (Sidhartha et al., 2015). Patients with HS are generally at high risk for mortality. In adults, hypertension followed by diabetes

mellitus are the major risk factors for medical complications of HS (Sidhartha et al., 2015) . Some of the non-modifiable risk factors for Hemorrhagic stroke are hypertension, cerebral amyloid, cholesterol, anticoagulation, antiplatelets alcohol, smoking, diabetes, microbleeds, drugs etc.

STROKE AND QUALITY OF LIFE

Several factors seem to be contributing to the decline in the quality of life of stroke patients. The severity of motor impairment or paralysis, lack of perceived social supports, impaired cognition, presence of co-morbid health problems, physical disability, dependency in activities of daily living, and significant depression (Martin et al., 1997) have been associated with a decline in quality of life of people post-stroke (Kran & Rastenyt, 2006). Risk factors for stroke include hypertension, family history, and diabetes mellitus (Richard Arbour, RN, MSN, CCRN, CNRN; Karen March, RN, MN, CCRN, 2005). Depression is an important post-stroke complication, which influence on person's quality of life, because it is associated with general disability and mortality (Rajesh Jain, K. S. Girhepunje, 2017).

MUSIC

Music is the science and art of assembling tones or sounds in a composition of harmony and consistency by positioning them in sequence, combination, and sequential relationships (Carolyn J. Murrock, 2009).

In ancient times music was called “*gāndharva*”, later it was called “*gīta*” or “*sangīta*”. Music is the subtlest and most refined type of fine arts, known in India as *Kalā Vidyā* in the name of *Sangīta*, which consists of the art of singing, dancing, and playing instruments (Debendra Narayan Satapathy, Sanjay Kumar Satapathy, 2018). Music according to *Sangīta Ratnākara* is “*Gītam Vādyam tathā Nrtyam trayam Saṅgītamucyate*” (Śārṅgadeva, 2007).

MUSIC THERAPY AND ITS ELEMENTS

Music therapy is an approach in which a music therapist works with an individual or a group to promote and facilitate communication, relationships, learning, and speech by using music and musical elements (sound, rhythm, melody, harmony, and pitch) (Lars Ole Bonde, 2002). People cite emotional influence and control as two of the key reasons why they listen to music. Music can induce a wide array of strong emotions, including joy, sorrow, anxiety, and peacefulness or tranquility. Musical satisfaction is closely related to the degree of emotional arousal (Sundar, 2007).

Indian music therapy is an amalgamation of ancient healing techniques and musical traditions (Sundar, 2007). To restore harmony in the physical and mental faculties and remove the imbalances that cause diseases, music therapy primarily employs time-specific *Rāga* with a specific tonal quality (Nagarajan, 2021a).

Indian classical music consists of seven key elements *Nāda*, *Śruti*, *Svara*, *Rāga*, *Tāla*, *Rasa*, and *Thāta*. *Nāda* refers to a sound that has a consistent quality with a single frequency or a group of similar frequencies (Nagarajan, 2021a). *Śruti* is a pitch position in an octave that corresponds to a particular frequency (Vidwans V, 2016). *Svara* is a specific pitch that is related to the fixed tonic

and derives its essence from it (TM Krishna, 2012). *Kōmal* and *Tīvra* are the names given to each note or *Svara* that is either lowered or raised in pitch (Karuna Nagarajan, Thaiyar M Srinivasan, 2014). *Tāḷa* is the rhythmic pattern (Nagarajan, 2021a). *Rāga* is a collection of specially picked tones (*svarās*) that, when blended, express the appropriate mood or emotion (Kar & Ganguly, 2015). *Rasa* is the essence of our emotions that exist in our body and mind that is capable of representing basic emotions like love, joy, wonder, courage, calmness, anger, sadness, fear, and disgust (Nagarajan, 2021a). The seat of emotion is mind or psyche, and the basis of *rasa* is an emotional state (*Bhāva*) or feeling. Each *Rāga* can produce a distinct aesthetic mood or *Rasa*. (Prasad, 1994) The term "*Thāta*" refers to a scale that has all seven notes in ascending order and descending order sequentially arranged (Sobhana Nayar, 1989).

THE SUGGESTED MECHANISM OF MUSIC ON STROKE BASED ON AYURVEDA

According to Ayurvedic principles, there are three categories of doshas, dhatus, and malas. The three doshas that govern the physiological and physicochemical functions of the organism are Vāta, pitta, and kapha. Vāta is in charge of all movements and sensations, as well as motor activities. Pitta is in charge of all physiochemical processes, including metabolism (production of heat and energy). Kapha provides the fluid matrix that permits the body to maintain its compactness or cohesiveness. In terms of health, these doshas are in a balanced state. Sickness can result from any disruption in the dosha balance. The type of disturbance determines the illness or symptom.

Abnormalities in the Vāta humour, for example, are regarded to be the cause of nervous and mental illnesses. The Vāta rogas (roga: illness) are how Ayurveda studies neurologic problems (Manyam, 1990). Pakshaghata is one of the eighty Nanatmaj Vāta Vikaras mentioned (Rajesh Jain, K. S. Girhepunje, 2017).

Rajas is Vāta's psychological component (David Frawley, 1999). Louis hay defines that the emotional cause of stroke is the rejection of life (Louise Hay, 1995). To alleviate these factors, we can employ ragas that generate *vīra* rasa, which can aid in building self-assurance and confidence and hence eradicating the emotional cause of stroke. This can be produced by ragas containing the *svaras Ga* and *Ni Komal*, which have frequencies of 288Hz and 432Hz, respectively (Nagarajan, 2021b).

Music therapy's primary treatment method is emotional healing. Emotional healing replaces negative emotions like criticism, fury, guilt, and resentment with positive feelings like tenderness, compassion, pleasantness, and tranquilly.

The *Sāmānya Viśeṣa Siddhānta* (Ch.Su.1/44.45.) idea in Ayurveda is appropriate regardless of the medicinal system that practitioners choose. According to this idea, components with similar properties have a higher value, whereas those with dissimilar features have a lower value (Loon, 1981). Therefore here we see the theory is applied, in order to eradicate the root emotional cause and we try to build the feeling of self assurance and courage.

A pleasant rasa can be produced by a certain type of music that expresses a positive mood and can be utilized to substitute an unpleasant rasa. Premeditated devotion to the *rāgās* from *Thāt Kāfi*,

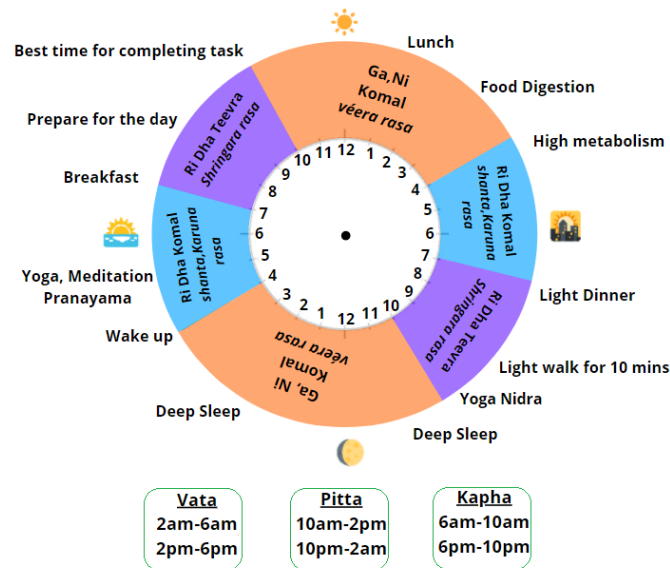
Asāvēri, Bhairavi and Tōḍi which uses *svarās Ga and Ni Kōmal*, develops *vīra rasa*, or the aesthetic mood of courage in the listener, and aids in the eradication of the rejected emotion (Nagarajan, 2021b), which is the fundamental cause of stroke in patients (Louise Hay, 1995).

Table 1 gives *Thāt* and some of its important *Rāgās* with prescribed timing to manage post-Stroke according to bio-rhythm theory (Nagarajan, 2021a).

Table 1 : That, Svaras and Ragas suggested for Stroke rehabilitation according to Biorhythm theory.							
Disturbed Doṣa: (Disorder)	Thāt and svarās used	Some important rāgās of this thāt	Carnatic equivalent	Some important rāgās	Time	Timing	
Vāta doṣa : (Insomnia)	Kāfi : <i>Ga, Ni Kōmal</i>	Kāfi	Kharaharapriya	Kharaharapriya	Anytime		
		Pīlu		Pīlu	Anytime		
		Bhimpalsri		Ābhēri	Afternoon	1pm-4pm	
		Brindāvani Sārang		Pushpalathika	Afternoon	1pm-4pm	
	Asāvēri : <i>Ga, Ni Kōmal</i>	Śuddha Sārang				Afternoon	1pm-4pm
		Asāvēri	Natabhairavi	Natabhairavi	Morning	7am-10am	
		Adāna		Darbāri Kānada	Midnight	10pm-1am	
		Jaunpuri		Jonpuri	Morning	10am-1pm	
		Darbāri Kānada		Darbāri Kānada	Midnight	10pm-1am	
		Bhairavi: <i>Ga, Ni Kōmal</i>	Bhairavi	Hanuma Tōḍi	Sindhuhairavi	Late morning	10am-1pm
Malkauns			Hindōḷam	Midnight	10pm-1am		
Tōḍi : <i>Ga, Ni Kōmal</i>	Bilakshani Tōḍi		Shubhapantuvarāli	Bahaduri Tōḍi	Morning	7am-10am	
	Tōḍi			Shubhapantuvarāli	Morning	7am-10am	
	Multāni			Gamakasamandam	Late afternoon	1pm-4pm	
	Gurjari Tōḍi			Śēkharachandrika.	Late morning	10am-1pm	
	Madhuvanti		Dharmāvati	Dusk	4pm-7pm		

In Indian classical Music, the Time theory of *Rāga* is a fascinating concept which explains that, the efficacy of each *Rāga* depends on the time of its application. According to this theory, a 24-hour day is divided into eight *Praharās* (3-hour time periods), with each *Rāga* allocated to a particular *prahar*. (Sundar, 2007) It can be connected with Ayurvedic analysis of predominance of *Doṣās* (*Vāta, Pitta, and Kapha*) in different times of a day as each *Doṣa* is said to be predominant during different stages of day and night (Devanand Upadhyay, 2016).

Fig1: Biorhythm theory and lifestyle prescription according to *Āyurveda (Dinacarya)*



According to *Āyurveda*, human body is composed of five fundamental elements (*Panchamahābhūtās*) each of which has its functional rhythm, which is expressed as a day-night routine (*Dinacarya*) in 24-hours and a seasonal schedule (*Ritucharya*) in a year. The theory behind daily routine is to live in a balanced state of three *Doṣās*. (Kaushik, Sharma, Sharma, Bhatkoti, & Bishwal, 2018) Fig1 shows the *Dinacarya* of the 24-hour cycle. It explains the complete routine to be followed. Getting up early in the morning benefits the person in two ways: it enhances physical health and boosts mental strength. (Akshar Kulkarni, 2014) On this account, we can deduce that practicing *Dinacarya* and *Ritucarya* helps to balance the *Doṣās* and thus shield us from illness thereby enhancing longevity (Megha Murali, Ragini Kumari, Kirti Soni, 2020).

CONCLUSION

Stroke is second among all neurological conditions in terms of frequency. Ageing, diabetes, hypertension, genetics, and other factors are some of the causes. Modern science has identified a number of causes, however according to *Ayurveda*; it is caused by disruptions in the *Doshas*. Unbalanced *Vāta* dosha is the principle cause.

Due to the potential adverse effects of all medications and other treatments, there is no effective treatment in today's modern medical system. In order to manage the problem, a multi-modality treatment for stroke is chosen, which can be used as an add-on therapy because it achieves outstanding outcomes. One's physical and emotional health can be affected by music, which is a potent tool. Because it can extract a wide range of emotions, it is a tool for mind-body medicine. The most important elements of Indian classical music are raga and rasa. Every raga elicits a distinctive aesthetic reaction. Stroke is referred to as *Vāta vyādhi* in *Ayurveda* (a illness produced by a *Vāta* disturbance). People recovering from a stroke can develop confidence and self-assurance with the use of ragas that trigger *vīra* rasa, which can help minimise dread and other related symptoms.

The most effective stroke treatments, according to research studies, are Ayurveda and yoga, which offer recommendations for a healthy lifestyle. Stroke management can benefit from the use of music in conjunction with a natural rhythm-establishing lifestyle modification as well as mental shifts based on Sadvritta and Yama and Niyama (social and personal practices) from Ayurveda and Yoga.

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