INTRODUCTION

Stroke is defined as the sudden loss of neurological function caused by an interruption of the blood flow to the brain. Neurological deficits must be present for at least 24 hours to be classified as stroke\(^1\).

Depending on the areas of brain affected, stroke leads to a variety of symptoms like hemiplegia, altered sensations, hand impairments, balance and co-ordination impairments etc.\(^2\). The most commonly affected artery is middle cerebral artery which mainly involves unilateral motor and sensory deficits of the upper extremity and face.\(^3\).

The hand has unique biomechanics and motor control capabilities which require a co-ordinated interplay of the intrinsic and extrinsic hand musculature. Thus, the hand is capable of a vast variety of functions like prehension, precision, grip, grasping, manipulation and transfers.\(^4\).

The hand has a bidirectional relationship with the brain which is necessary for execution of unique achievements of mankind.\(^5\). Stroke leads to alterations in the muscle tone affecting the motor functions. The rate of regaining isolated movements is slow as the area responsible for controlling the hand functions in the motor cortex is large which delays recovery of hand post stroke.\(^6\).

Conventional exercises are those exercises that are traditionally practiced since ancient times and are accepted worldwide.\(^7\). These exercises concentrate on the upper extremity as whole. Setting a structured protocol concentrating mainly on the hand is necessary for improvement of functional mobility and enhancing quality of life in stroke survivors.

METHODS

This was a comparative study conducted on 34 subjects who were equally divided into two groups using simple random sampling with lottery method. Conventional treatment was given to both the groups as a baseline treatment. The patients were selected according to the inclusion and exclusion criteria. Informed consent was taken from the patient and patient’s caretaker. Inclusion criteria: (1) Subjects with middle cerebral artery involvement (2) Subjects with Brunstrom recovery stage 2 and above (3) Subjects with impairment of hand function (4) Both genders. Exclusion criteria: (1) Wrist and Hand Fractures (2) Subjects with stroke secondary to traumatic brain injuries (3) Subjects with transient ischemic attack.

The treatment was given regularly for 5 days/week for 4 weeks.

- Group A was given conventional training- Passive/Active assisted exercises for upper limb, Mat exercises, Electrical stimulation- Wrist and finger extendors, Transfer training, Therapeutic gymnasium exercises.
- Group B was given specific intrinsic and extrinsic muscle training- Active Stretching exercises, Dumbbell exercises, Pinching Cloths-spins, Hand ball exercises, Squeezing ball, Thumb roll, Pinching the ball, Table roll, Cutting papers, Making a bead necklace, Clay exercises, Rubber band exercises, Towel Exercises, Functional training with conventional training.

RESULTS:

**Chedoke Arm and Hand Activity Inventory (CAHAI) - intragroup comparison using paired t-test.**

In Group A the mean score on pre-intervention was 41.94±16.72 and 43.17±16.91 post-intervention. The p value was 0.0003, extremely significant.

In Group B the mean score on pre-intervention was 42.82±16.32 and 56.23±15.68 post-intervention. The p value was <0.0001, extremely significant.

**Jebsen's Hand Function Test (JHFT) - intragroup comparison using paired t-test.**

In Group A the mean score on pre-intervention was 172.76±30.85, 54.52±18.15, 77.82±16.93, 111.17±23.31, 93.11±16.55, 130.58±17.96, 151.29±16.49 and post intervention was 171.11±31.21, 53±18.38, 76.52±17.08, 109.76±23.85, 91.58±17.01, 128.70±18.55, 148.94±16.79 for writing, page turning, picking small objects, simulated feeding, stacking checkers, picking large light objects, picking large heavy objects respectively. The p value was 0.0001, <0.0001, <0.0001, <0.0001, <0.0001, <0.0001, <0.0001 in the respective components which is extremely significant.

In Group B, the mean score on pre-intervention was 168.70±30.64, 52.76±18.05, 76.88±16.50, 108±22.82, 91.41±16.62, 128.64±18.02, 150.11±15.94 and post intervention was 135.70±24.84, 128.70±18.55, 148.94±16.79, 110.29±15.28, 52.29±15.14, 176.17±23.31, 50.29±16.69, 97.58±14.85, 117.17±15.62 for writing, page turning, picking small objects, simulated feeding, stacking checkers, picking large light objects, picking large heavy objects respectively. The p value was <0.0001, <0.0001, <0.0001, <0.0001, <0.0001, <0.0001 in the respective components which is extremely significant.
JHFT – intergroup comparison using unpaired t-test
On comparing the pre-interventional values, the results between the two groups revealed that there was no statistically significant difference seen in the p values=0.0260.

Table 2- Pre and Post comparison of JHFT score between the group

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean±SD</th>
<th>p value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group A</td>
<td>Group B</td>
<td></td>
</tr>
<tr>
<td>Pre training</td>
<td>41.94±16.72</td>
<td>42.82±16.32</td>
<td>0.8773</td>
</tr>
<tr>
<td>Post training</td>
<td>43.17±16.91</td>
<td>56.23±15.68</td>
<td>0.0260</td>
</tr>
</tbody>
</table>

DISCUSSION
Hand impairment is a common motor impairment after stroke and is a major limiting factor increasing the dependency and reducing efficiency and social participation. When patients are unable to use their affected hand they compensate either by using the non-affected hand more or using affected hand in a possible way thus learning abnormal compensatory movements.

Till date there are many neuropsychological techniques devised for upper extremity and hand functioning such as Constraint induced movement therapy-a multifaceted intervention associated with a moderate reduction in disability with no evidence of persisting benefit[14]. Functional electrical stimulation which has a positive improving effect on the upper limb motor function post stroke[6]. Upper extremity task-oriented training that improves upper extremity functional use in patients with mild/moderate paresis but they have their own limitations.

This study was undertaken considering all the mentioned points and the aim was to find out the effect of intrinsic and extrinsic muscle training on quality of hand functions in stroke patients.

Post training improvement in hand function is due to plasticity following brain lesion. Repetitive exercises following stroke can help in formation of new and effective functional connections within remaining brain tissue. It can be due to specificity of the exercise programme that helped in achieving gross and fine motor control. Intrinsic and extrinsic muscle training might have helped the patients to have a better motor planning thus recruiting specific motor units. Although skilled performance was initially delayed Intrinsic and extrinsic muscle training added specificity and variability thus helping in retention of the skills. In conventional training the activities were done as a whole and not by breaking down in components which might have limited the transfer of training. While conventional training helped in early acquisition of skills, retention and specificity was achieved by specific intrinsic and extrinsic muscle training. This all can be supported by a statement of Kottke-If the practiced activity has been precise, the engram will be extremely significant.

This study thus shows that intrinsic and extrinsic muscle training and conventional training are both effective, but the combination of both has superior effects as compared to individual techniques.

CONCLUSION:
Conventional training was effective in achieving gross motor skills but specific intrinsic and extrinsic muscle training significantly improved overall hand functions thus improving quality of hand functions in stroke patients.

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