Repetitions matter for patient's recovery from CVA

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Focused Question

How many repetitions do post CVA patient's complete during an OT or PT treatment session and how does it compare to current research

Background

- Current research indicates that repetitions matter in the promoting neuroplastic changes
  - It is how those reps are delivered that appear to have the largest impact on neural activity (Lang, MacDonald, Gnip, 2007).
  - The total number of repetitions completed to influence change is still unclear (Lang et al., 2009).
- Repetitions completed within a therapy session are only one piece of the equation.
  - It is the carrying over from tx session to compliance with HEP that potentially elicits the larger number of overall movements.
  - Which could impact the overall outcome for the client.
- There are several factors that influence the outcome; two of which are
  - Specificity of movement (active, passive or purposeful movements)
    - Researchers have reported that the more purposeful the movements the greater the increase in neural activity is elicited (Klein & Jones 2008).

Background

- Intensity (ex. number of reaching and or gait steps taken)
  - Higher numbers of repetitions provoke long-term potentiation when compared to rats completing a lower number (Kleim & Jones, 2008)
  - Rats completed between 400-600 repetitions of a reaching task per day (Lang et al., 2007) (Lang et al.,2009)
- Lang et al.,2009 states that doses of movement practice currently being provided during CVA rehabilitation are substantially smaller than doses seen in animal studies.
  - It is inherently easier to entice a rat or monkey to complete multiple repetitions with rewards
- That said, Fine and Thoroughman (2006), noted that in an effort to determine the interactions between motor feedback and motor adaptions in humans, healthy adults completed 300 repetitions of a reaching task.
- Boyd & Weinstein, (2006), evaluated the effects of explicit feedback on skilled learning post CVA. People post CVA performed 500 movements of a serial reaction time task.

Background

- Lastly; Lang et al., (2007) stated that clinical experience suggests people complete significantly fewer repetitions during rehabilitation, they were not able to find data to support or refute this assumption.
- Researchers have completed several observational studies to determine the number and type of repetitions completed during a treatment session
    - Active, passive, and purposeful (functional) movements, GAIT, balance, transfer (Lang et al., 2007, 2009)
- More reps are seen with GAIT training vs Upper extremity movements
    - It has been surmised that this is the reason for Gait recovers before UE recovery (Lang et al., 2007)

Methods

- Observational study completed with the approval of Providence IRB
- 21 patients with hemiparesis were selected for inclusion in the study
- Protocols were established using the methods and definitions found in “Counting Repetitions: An Observational study of Outpatient Therapy for people with Hemiparesis Post Stroke” (Lang et al., 2007)
- Data was collected from February 10 – March 13, 2020
- Areas observed were upper and lower extremity movements
  - Further subdivided into active, passive, and purposeful movements
  - Gait episodes and steps, stair episodes and stair steps, balance, and transfers

Methods continued

- Treatment time; defined as the time spent engaging in active interventions beyond gathering subjective data.
- Type of therapist; OT or PT
- Data collection was completed by one observer
- Observer completed 12 practice data collection sessions
  - To ensure consistency
- A research randomizer was used to select patient's to be observed when multiple patients were available simultaneously.
- No demographic information was collected for patients or therapist
- Data collection was documented of form created by observer
- SPSS was utilized to analyze data once collected

Results

- A total of 57 treatment sessions were observed, 32 OT sessions and 25 PT sessions
- Average treatment session was 40 ± 4 minutes, time was record from the point which therapeutic activity began to termination
- Upper extremity
  - Active movements were observed in 44 of 57 sessions
  - Passive movements were observed in 35 of 57 sessions
  - Purposeful movements were observed in 28 of 57

Results

- Lower Extremity
  - Active movements were observed in 28 of 57 sessions
  - Passive movements were observed in 5 of 57 sessions
  - Purposeful movements were observed in 20 of 57
- Because Gait and stairs were counted separately, it was expected that lower extremity repetitions would elicit smaller numbers
- GAIT: Episodes and steps were observed in 55 of 57 sessions
- Stair Episodes and Steps were observed 7 of 57 sessions
- Transfers were observed in 44 of 57 sessions
- Balance was observed in 4 of 57 sessions

Results: Upper and Lower Extremity

Report				
Therapist Type		Upper Extremity Active Movement	Upper Extremity Passive Movement	Upper Extremity Purposeful Movement
OT	Mean	**156.21**	**82.18**	**64.83**
	N	29	28	18
	Std. Deviation	297.720	84.769	81.376
PT	Mean	**73.33**	**17.29**	**65.00**
	N	15	7	10
	Std. Deviation	97.289	10.095	132.034
Total	Mean	**127.95**	**69.20**	**64.89**
	N	44	35	28
	Std. Deviation	249.756	80.112	99.902

Report				
Therapist Type		Lower Extemity Active Movement	Lower Extemity Passive Movement	Lower Extemity Purposeful Movement
OT	Mean	**39.40**	**4.00**	**26.60**
	N	5	1	10
	Std. Deviation	38.083	.	35.638
PT	Mean	**327.83**	**16.00**	**64.60**
	N	23	4	10
	Std. Deviation	307.973	17.359	91.693
Total	Mean	**276.32**	**13.60**	**45.60**
	N	28	5	20
	Std. Deviation	300.254	15.962	70.457

Results: GAIT, Stairs, Balance, Transfers

Report							
Therapist Type		Gait Episode	Gait Steps	Stair Episodes	Stair Steps	Transfers	Balance
OT	Mean	**4.77**	**116.19**			**3.68**	
	N	31	31			22	
	Std. Deviation	3.180	100.716			2.784	
PT	Mean	**9.46**	**345.44**	**14.43**	**31.57**	**8.59**	**18.25**
	N	24	25	7	7	22	4
	Std. Deviation	6.248	295.301	30.708	24.630	8.545	7.228
Total	Mean	**6.82**	**218.54**	**14.43**	**31.57**	**6.14**	**18.25**
	N	55	56	7	7	44	4
	Std. Deviation	5.267	238.346	30.708	24.630	6.753	7.228

Results: Descriptive statistics

Statistics				
		Upper Extremity Active Movement	Upper Extremity Passive Movement	Upper Extremity Purposeful Movement
N	Valid	44	35	28
	Missing	13	22	29
Mean		**127.95**	**69.20**	**64.89**
Std. Deviation		249.756	80.112	99.902
Sum		**5630**	**2422**	**1817**

Statistics				
		Lower Extemity Active Movement	Lower Extemity Passive Movement	Lower Extemity Purposeful Movement
N	Valid	28	5	20
	Missing	29	52	37
Mean		**276.32**	**13.60**	**45.60**
Std. Deviation		300.254	15.962	70.457
Sum		**7737**	**68**	**912**

Results: Descriptive statistics

Statistics							
		Gait Episode	Gait Steps	Stair Episodes	Stair Steps	Transfers	Balance
N	Valid	55	56	7	7	44	4
	Missing	2	1	50	50	13	53
Mean		**6.82**	**218.54**	**14.43**	**31.57**	**6.14**	**18.25**
Std. Deviation		5.267	238.346	30.708	24.630	6.753	7.228
Sum		**375**	**12238**	**101**	**221**	**270**	**73**

Results: How we compare

Prov Rehab

Upper Extremity	Reps/Session	SD
Active	127.95	± 249.7
Passive	69.20	± 80.11
Purposeful	64.89	± 99.9
Lower Extremity		
Active	276.32	± 300.25
Passive	13.60	± 15.96
Purposeful	45.60	± 70.45

Lang et al., 2007

Upper Extremity	Reps/Session	SD
Active	38.8	± 30.9
Passive	33.9	± 26.6
Purposeful	12.0	± 12.3
Lower Extremity		
Active	33.4	± 33.4
Passive	6.3	± 5.0
Purposeful	8.0	± 12.3

Results: Comparison

Prov Rehab

	Reps/Session	SD
GAIT: Episodes	6.82	± 5.26
GAIT: Steps	218.54	± 238.34
Stair: Episodes	14.43	± 30.7
Stair: Steps	31.57	± 24.6
Transfer	6.14	± 6.75
Balance	18.25	± 7.22

Lang et al., 2007

	Reps/Session	SD
GAIT: Episodes	3.8	± 3.3
GAIT: Steps	291.5	± 351.0
Stair: Episodes	4.5	± 2.0
Stair: Steps	21	± 26.1
Transfer	10.5	± 9.4
Balance	6.0	± 2.1

Limitations

- Study design was an observational study
- Therapist's prior knowledge of the study being conducted could have impacted how treatment sessions were shaped during observation.
- Active UE movements numbers could be skewed due to how exercise equipment repetitions were counted.

Bottom line for OT and PT

- With the availability of current research it is necessary that therapists keep up with the latest information to be able to provide the best evidenced based care for our clients.
- Having a better understanding of the amount and type of repetitions that provide the best outcomes to the patients has the potential to assist the therapist in shaping a more function-based therapy session.
- OT and PT are at a distinct advantage to address these impairments using meaningful functional tasks
- It it clear that further research is needed to bolster the research that is currently available

Lessons Learned

- Add category for upper extremity active movements to capture those repetitions completed on exercise equipment
- More clearly define what constitutes an active movement
  - Should movements completed with the help of unaffected UE be counted as active movements?
  - If your unaffected UE is doing to majority of the work?
- Count either UE or LE/ Gait/Stairs within a session
  - Don’t count every movement within a session
    - Could have positive impact on count
- Data capture should be scheduled to allow a gap between sessions
  - If session observed runs long, this alleviates need to rush to next client

References

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Kleim, Jeffrey A., & Jones, Theresa A. (2008). Principles of experience-dependent neural plasticity: Implications for rehabilitation after brain damage.(Report). *Journal of Speech, Language, and Hearing Research, 51*(1), S225-S239.

Local Resource Guide: Includes the following

- Home Modifications and Equipment
- Adult daycare Service Centers
- Adult Senior Centers
- Adult Senior Volunteer Programs
- Community Mental Health Services
- Health and Dental Clinics
- Home Delivered Meal Programs
- In home Service Organizations
- Loan Closets- Medical Equipment
- Referral & Resources
- Transportation Services
- Traveling Professionals