10-2013

Clinical Reasoning in the use of Slings for Patients with Shoulder Subluxation After Stroke: A Glimpse of the Practice Phenomenon in California

Kitsum Li
Department of Occupational Therapy, Dominican University of California, kitsum.li@dominican.edu

Naoko Murai
Dominican University of California

Simon Chi
Dominican University of California

https://doi.org/10.3928/15394492-20130912-01

Clinical reasoning in the use of slings for stroke patients with shoulder subluxation: A glimpse of the practice phenomenon in California

Kitsum Li, OTD, OTR/L

Naoko Murai, MSOT,

Simon Chi, MSOT

The authors declare no conflict of interest

Correspondence information: Kitsum Li, OTD, Assistant Professor, Department of Occupational Therapy, Dominican University of California, 50 Acacia Ave, San Rafael, CA 94901.

kitsum.li@dominican.edu

Key Words

Orthosis, Upper extremity management, Cerebral Vascular Accident

Abstract

Literature reports the frequent use of shoulder slings by occupational therapists for the management of post-stroke shoulder subluxation despite the low evidence for its efficacy. To understand the clinical context that defies current research evidence, a survey was distributed among California occupational therapists. One hundred and sixty-eight participants responded to the survey, answering questions regarding the occurrences and clinical reasoning in the use of shoulder sling with patients post stroke. 81.5% of the respondents reported the use of shoulder sling. However, the actual sling prescription was limited to 28.4% of their patients. Slings were primarily prescribed for upper extremity management during functional mobility and for pain reduction. The orthopedic sling was the most frequently used sling. Reasons to use the orthopedic sling were largely based on pragmatic reasoning such as convenience and cost factors. On the contrary, therapists with advanced training were found to be more likely to apply procedural reasoning when choosing the proper sling for their patients.

Introduction

Nearly 800,000 people are affected by stroke each year (Center for Disease Control, 2011; Roger et al., 2012). Shoulder subluxation is one of the secondary complications from stroke that could lead to functional loss of the upper extremities (Kumar & Swinkels, 2009; Stolzenberg, Siu & Cruz, 2012). The management of shoulder subluxation with supportive devices, such as slings or arm trough, presents not only challenges but also possible negative

effects due to the difficulty in providing proper alignment at the glenohumeral joint (Stolzenberg et al., 2012). Lack of agreement on the cause of shoulder subluxation and absence of large scale randomized controlled studies for treatment modalities make it difficult for healthcare practitioners to apply sound clinical decisions (Dieruf, Poole, Gregory, Rodriguez, & Spizman, 2005; Foongchomcheay, Ada, & Canning, 2005; Morley, Clarke, English, & Helliwell, 2002). Literature reported the frequent use of a supportive device for the management of shoulder subluxation despite the low evidence for its efficacy (Dieruf et al., 2005; Foongchomcheay et al., 2005; Gustafsson & Yates, 2008; Morley et al., 2002; Vasudevan & Vasudevan, 2008). Gustafsson and Yates (2008) reported that occupational therapists surveyed (n=55) frequently chose treatment techniques that did not have significant supporting evidence, such as pillows (98%) and slings (61%). On the other hand, treatment modality with high evidence, such as electrical stimulation, was used less frequently (39%). However, this study did not investigate the clinical reasoning behind the choice of the low evidence techniques.

The effectiveness of a shoulder sling in reducing shoulder subluxation was reported in the 1990s (Brooke, De Lateur, Diana-Rigvy, & Questad, 1991; Williams, Taffs, & Minuk, 1998; Zorowitz, Idank, Ikai, Hughes, & Johnston, 1995). While some authors warned that the prolonged use of the shoulder sling could facilitate synergistic flexion patterns and lead to soft tissue contracture (Stolzenberg et al., 2012; Vasudevan & Vasudevan, 2008; Zorowitz et al., 1995), others also found that the use of certain types of slings could create horizontal displacement in the glenohumeral joint of the affected shoulder (Dieruf et al., 2005; Zorowitz et al., 1995). Though the Bobath sling was designed to maintain the humerus in an abducted and externally rotated position, it was not found to be an effective support to maintain the vertical glenohumeral alignment (Stolzenberg et al., 2012; Zorowitz et al., 1995). Some studies also

reported an increase in the horizontal displacement with the use of the Bobath sling (Brooke et al., 1991; Morley et al., 2002; Zorowitz et al., 1995). The hemi sling, which is similar to the Harris hemi sling, was found to correct vertical displacement better than the Rolyan sling or the Bobath sling (Brooke et al., 1991; Morley et al., 2002; Zorowitz et al., 1995). However, when both vertical and horizontal displacements were measured, the Roylan sling was found to have better total displacement correction than the hemi sling or the Bobath sling (Morley et al., 2002; Zorowitz et al., 1995).

The GivMohr sling, on the other hand, was found to reduce the vertical displacement of the shoulder of a flaccid upper extremity while preventing overcorrection of both vertical and horizontal displacements (Dieruf et al., 2005). The orthopaedic (triangular) sling was also found to be more effective than the Bobath sling, hemi sling, arm trough, and lap tray in reducing shoulder subluxation (Moodie, Brisbin &Morgan, 1986). The orthopaedic (triangular) sling, however, positions the shoulder in an adducted and internally rotated position and encourages excessive immobilization, thus reinforces pathological flexion of the arm (Moodie et al., 1986; Morley et al., 2002, Stolzenbery, et al., 2012). In addition, a recent Cochrane review (Ada, Foongchomcheay & Canning 2005) concluded insufficient evidence to support the use of slings for shoulder subluxation management for individuals after stroke. Thus, the evidence favoring the use of shoulder slings in the management of post-stroke shoulder subluxation remains a controversy.

Smith and Okamoto (1981) formulated guidelines for selecting slings for the post-stroke patient in occupational therapy practice. The factors to be considered included appropriate joint positioning, weight distribution, effect of changes in body positioning, allowance for hand function, effect on skin integrity, cost, durability, and easy donning/doffing to facilitate patient's

compliance (Smith & Okamoto, 1981). The guidelines emphasize the importance of individualized therapy in the decision-making process when selecting an appropriate sling. For instance, a patient with strong neglect may need a sling that limits mobility in order to protect the limb, while a patient without neglect should use a sling that allows movements and discourages the flexion synergy (Smith & Okamoto, 1981). These guidelines provide a path for possible clinical reasoning that occupational therapists might apply.

Occupational therapists employ various types of clinical reasoning to guide practices. Procedural reasoning provides biomedical and biomechanical approaches to clinical problem solving (Pedretti, Pendelton, & Scholtz-Krohn, 2006). While narrative reasoning incorporates patient's motivation and compliance to the intervention, interactive reasoning gives consideration to a patient's view of the illness experience to formulate more finely tailored intervention (Mendez & Neufeld, 2003; Pedretti, Pendelton, & Scholtz-Krohn, 2006; Schell & Cervero, 1993). Pragmatic reasoning gives consideration to organizational, political, or economic realities that surround clinical practice. Such external factors can affect occupational therapists' decision in selecting interventions (Pedretti, Pendelton, & Scholtz-Krohn, 2006). Conditional reasoning is a predictive approach to formulate the intervention that focuses on the long-term outcomes. It also builds on therapists' experience to hypothesize the expected outcome (Mendez & Neufeld, 2003; Pedretti, Pendelton, & Scholtz-Krohn, 2006; Schell & Cervero, 1993).

To the best of our knowledge, the reason for the persistent use of shoulder sling in our clinical practice has not been investigated. In addition, the discrepancy between the frequency of sling use and the level of supporting evidence has not been recently addressed. As stroke

patients recover and regain mobility, the ability of healthcare practitioners to provide the protection for the stroke-affected limb with quality practice becomes a valid concern.

The purpose of this study was to survey occupational therapy practitioners practicing in the state of California. The investigation of the occurrence and the clinical reasoning in the use of shoulder sling adds to the understanding of the clinical contexts that defy the current research evidence.

This study was designed to answer the following research questions.

1. What is the occurrence of the use of shoulder sling in the post-stroke occupational therapy practice across the clinical settings?
2. What is the clinical reasoning for using the shoulder sling?
3. What types of sling are commonly used in the post-stroke occupational therapy practice?
4. What is the clinical reasoning for the selection of the particular sling?

Methods

A multiple-choice self-report questionnaire was developed to survey occupational therapy practitioners who practice in post-stroke rehabilitation in the state of California. The questionnaire contained demographic questions, including the attainment of additional training. The additional trainings included in the questionnaire were Neurodevelopmental Treatment (NDT), Neuro-Integrative Functional Rehabilitation And Habilitation (Neuro-IFRAH), functional electrical stimulation (FES), neuromuscular electrical stimulation (NMES), and taping/strapping.

An anonymous online survey was conducted between January 30 and April 1, 2012, among approximately 2,000 members of the Occupational Therapy Association of California

(OTAC). Additionally, an anonymous onsite survey was conducted among the estimated 500 attendees of the OTAC's Spring Symposium, which took place on March 31 and April 1, 2012 in Anaheim, California.

The recruitment of research participants was conducted in compliance with the Occupational Therapy Code of Ethics to ensure the participants' autonomy and confidentiality. Invitation to participation included information describing the purpose and procedure of the study, statements that the participation to the study was voluntary and that the participants' response to the survey served as their consent of participation. Approval from the Dominican University of California Institutional Review Board for the Protection of Human Subjects was obtained prior to the implementation of the study.

Data Analysis

Descriptive statistics was used to delineate the popularity of the use of sling and its clinical reasoning. Additional analysis, z-test for proportion, was conducted to further explain the factors that influenced the reported use of slings and its clinical reasoning. SPSS statistical package version 12.0 for Windows and Microsoft Excel 2010 were used to complete the data analysis.

Results

A total of 168 California occupational therapy practitioners completed the survey. The online survey yielded 129 respondents, and the onsite survey at OTAC's Spring Symposium yielded additional 39 respondents. These amount to approximately 6% of the total members of the OTAC and 8% of the attendees at the Spring Symposium event.

Demographics

Of the 168 respondents, only 155 respondents reported on their education levels. Practitioners with Bachelor's and Master's degrees were 47% (n=73) and 35% (n=54) respectively, while 13% (n=20) of the respondents were certified assistants and 5% (n=8) had Doctorate degree in occupational therapy. One hundred and fifty-eight respondents reported on their years of clinical experience. Majority of the respondents reported to have more than 10 years of clinical experience (n= 117, 74%), and 69% (n=109) reported to have more than 10 years of clinical practice particularly in the stroke rehabilitation. For clinical settings, respondents were allowed to pick more than one practice settings, if applicable. A total of 53% (n=100) of the respondents reported to practice in skilled nursing facilities or acute rehabilitation settings. Other practice settings include acute care (23%), outpatient clinic (18%), home care (10%), sub-acute care (5%) and other (6%).

Research Question 1 (The occurrence of the use of sling)

Survey Question: *'Approximately for what percentage of your stroke patients with shoulder subluxation or at risk of shoulder subluxation did you use a shoulder sling in the last 12 months?'*

All 168 respondents answered this question. The multiple choice answers offered in this question were "None of them", "1-25%", "26-50%", "51-75%", "76-99%", and "All of them". The result (figure 1) indicated that 81.5% of the total respondents prescribed shoulder slings to their stroke patients by providing answers to one of the provided choices other than "None of them". On average, 28.4% of stroke patients were prescribed with shoulder slings by the respondents in the last 12 months.

Research Question 2 (Clinical reasoning to use the shoulder sling)

Survey Question: *'What was the reason for using a shoulder sling for those patients?'*

Fourteen clinical reasoning choices plus an 'other' choice were offered in this question

(Figure 2). One hundred and forty respondents answered this question. The respondents were asked to select as many choices as applicable. The five most frequently selected clinical reasoning were 'To reduce stress from gravitational pull while a patient is standing or walking' (n=100), 'To protect the upper extremity during transfer' (n = 93), 'To reduce shoulder pain' (n=87), 'To maintain proper glenohumeral alignment' (n=77), and 'To correct glenohumeral alignment of subluxed shoulder' (n=59). The top three choices represent interventions to address upper extremity management in functional mobility and for pain reduction. The fourth and the fifth choices represent the remediation of the glenohumeral alignment. Among 89 respondents who chose the clinical reasoning for correction or maintenance of glenohumeral alignment, eighty-five respondents also chose the clinical reasoning choices for functional mobility or for pain reduction, and four respondents chose these two reasons as a sole reason for the sling use.

Research Question 3 (The commonly used sling)

Survey Question: *'Which sling did you use most in the last 12 months?'*

Sling choices offered in this question were GivMohr sling, Bobath sling, orthopedic (triangular) sling, North Coast hemi sling, Harris hemi sling, C.V.A sling, Rolyan sling, and 'other' (Figure 3). One hundred thirty four respondents answered this question. The most prevalent shoulder sling used by the surveyed California's occupational therapy practitioners was the orthopedic (triangular) sling (n = 53), followed by the GivMohr sling (n = 41). These two slings were chosen with much higher frequency than any other slings.

Research Question 4 (Clinical reasoning for the selection of the particular sling)

Survey Question: *'What is your clinical reasoning for choosing the one you used most?'*

Sixteen clinical reasoning choices plus an 'other' choice were offered in this question. One hundred thirty four respondents answered to this question. The respondents were asked to select as many choices as applicable.

The reasoning choices offered in the question were grouped as procedural reasoning, pragmatic reasoning, interactive and narrative reasonings, conditional reasoning, and other (Table 1). The numbers in table 1 illustrate the frequency of clinical reasoning behind each chosen sling. Between the two most chosen slings, the orthopedic (triangular) sling and the GivMohr sling, a different clinical reasoning pattern emerged. The pragmatic reasoning pattern was found to be more prominent for those selecting the orthopedic (triangular) sling than those selecting the GivMohr sling. On the other hand, the procedural reasoning pattern was found to be more prominent in selecting the GivMohr sling than the orthopedic (triangular) sling (Figure 4). Using the Z-test for proportion, we compared the proportions of the GivMohr sling usage and that of the orthopedic (triangular) sling among the respondents who considered at least one procedural reasoning choice and among those who did not consider procedural reasoning. The respondents who considered procedural reasoning were more likely to select the GivMohr sling (59.5%) than those who did not consider procedural reasoning (14.5%) ($z=5.21$, 95% confidence interval [CI] [.2841, .6173] $p< .001$). On the other hand, the respondents who did not consider procedural reasoning were more likely to select the orthopedic (triangular) sling (60.24%) than those who considered procedural reasoning (2.38%) ($z=6.22$, 95% CI [.4637, .6935] $p< .001$).

Influence of additional trainings on selecting a sling

Among 134 respondents who responded to the questions of sling choice and its clinical reasoning, we investigated if the attainment of additional trainings in the field of post-stroke rehabilitation influenced their sling selection and the reasoning patterns.

Occupational therapy practitioners who have post-graduate trainings in NDT/NeuroIFRAH, electrical stimulation (FES/NMES), or taping/strapping were less likely to choose the orthopedic (triangular) sling. There was a significant difference between the proportions of practitioners with at

least one of the above-mentioned trainings who selected the orthopedic sling (27.8%) and the proportion of those without the training (56.4%) (z=3.32, 95% CI [.1210, .4493] p < .001).

When selecting a sling, occupational therapy practitioners who have post-graduate trainings in NDT/NeuroIFRAH, electrical stimulation (FES/NMES), or taping/strapping were less likely to use pragmatic reasoning and more likely to use procedural reasoning than those without the additional training. In the survey question for the reason in selecting a particular sling, the proportions of the respondents who utilized the pragmatic reasoning were 48.10% (95% CI [.3708, .5912] among the practitioners with some post-graduate training and 74.55% (95% CI [.6304, .8606] among those without the training. The proportion for the use of pragmatic reasoning was significantly greater among the practitioners without the training than among those who attained some post-graduate training (z=3.06, 95% CI [.1051, .4239] p<.01). On the other hand, the proportions of the respondents who utilized the procedural reasoning were 44.30% (95% CI [.3335, .5525] among the practitioners with some post-graduate training and 12.73% (95% CI [.0392, .2154] among those without the training. The proportion for the use of procedural reasoning was significantly greater among the practitioners who attained some post-graduate training than among those without the training (z=3.88, 95% CI [.1752, .4564] p< .001).

Discussion

Our study supports the study by Gustafsson and Yates (2008), who reported the frequent use of slings in post-stroke rehabilitation by the occupational therapy practitioners they surveyed While 61% of their survey respondents used a sling, our result showed as much as 81.5% of the surveyed occupational therapy practitioners reported the use of shoulder sling in their practice. However, the actual prescription of the sling was limited to only 28.4% of the stroke patients with shoulder subluxation or at risk of shoulder subluxation in the 12 months prior to the survey.

Our result implies that occupational therapy practitioners use discretion and apply individualized clinical reasoning in the use of shoulder sling for the management of shoulder subluxation.

Specific clinical contexts emerged in the use of shoulder sling. Shoulder slings were often used in the context of supporting the involved upper limb during functional mobility and for pain management. The use of a shoulder sling solely for correcting subluxation or maintaining joint integrity was rare.

Although our results suggest management of the upper extremity during functional mobility as the primary context for applying the sling, studies on the effect of use of sling in functional mobility are rare. Three studies investigated the effects of shoulder slings on walking speed, energy consumption, gait symmetry and pattern (Hesse et al., 2013; Han et al., 2001; Yavuzer & Ergin, 2002). The results of these studies exhibited positive effects. The study by Yavuzer and Ergin (2002) with 31 study participants demonstrated improved walking speed and gait pattern in stroke patients with hemiparesis when they wore an arm sling. Similarly, Han et al. (2001) also reported increased gait speed and reduced oxygen consumption in post-stroke patients when they walked with an arm sling on the affected limb, compared to the outcomes while walking without an arm sling. A recent study using a newly-designed shoulder orthosis to provide support to the flaccid shoulder found improved gait symmetry in individuals with paretic lower extremity after stroke (Hesse et al., 2013). These confirm that shoulder sling can be an appropriate modality enhancing functional gait for individuals with hemiparesis after stroke. However, due to the possible soft tissue changes and pathological muscle tone reinforcement with the use of a shoulder sling, care should be applied in the routine use of slings and perhaps only short-term use during mobility-related activities will be more appropriate (Stolzenberg et al., 2012).

The efficacy of the shoulder sling specifically for pain reduction has yet to be demonstrated (Ada et al., 2005; Kumar & Swinkels, 2009). The complex etiology of shoulder pain with or without subluxation in stroke-affected upper limb increases the challenge of its clinical management. Although Hartwig, Gelbrich & Griewing (2012) found that a new shoulder orthosis, the Neuro-Lux, may be able to reduce and prevent the development of shoulder-hand syndrome post-stroke, the association between shoulder subluxation and shoulder pain remains uncertain (Kumar & Swinkels, 2009). Attention should be paid to the practitioners' reliance on the shoulder sling for pain management without confirmed evidence.

This study revealed the high occurrence in the use of orthopedic (triangular) sling and the GivMohr sling. The clinical reasoning patterns for using these two most chosen slings were distinctively different. While the GivMohr sling was chosen mainly for the management of joint integrity, the orthopedic (triangular) sling was chosen because of non-procedural reasoning, such as cost, the availability in facilities, easy donning/doffing, and other external influence, such as 'Physician prescribed it' (Table 1 & Figure 4). The clinical reasoning pattern in selecting the orthopedic (triangular) sling exhibited a deviation from the original clinical reasoning to use a sling, which was intended for the clinical management in the context of functional mobility and pain management. Although the orthopedic (triangular) sling provides support to the humerus, its adverse effects of encouraging immobilization and flexor synergy are well documented (Moodie et al., 1986; Morley et al., 2002; Stolzenberg, et al., 2012). These incongruent reasoning patterns between the prescription and the selection of shoulder slings indicate that the occupational therapy practitioners' clinical management might have been affected by factors such as convenience and cost. Considering that the shoulder sling is not a reimbursable item by

the payers of health care services, pragmatic clinical reasoning appears to have won over the originally intended procedural reasoning in actual practices.

The attainment of additional trainings in post-stroke rehabilitation appeared to have an influence on the practice pattern in the use of shoulder slings. Our results indicated that there was lower usage of the orthopedic (triangular) sling by practitioners with additional training, along with higher reliance on the procedural reasoning and lower reliance on the pragmatic reasoning. These results imply that additional trainings may have increased awareness of the adverse effects from certain sling types and encouraged assertiveness in procedural reasoning that promotes better clinical management.

This current glimpse into the "practice phenomenon" in the use of shoulder sling does not represent the best practice in post-stroke rehabilitation. While pragmatic clinical reasoning often set up the parameter in our practice, it is our ethical obligations to provide interventions that are evidence-based, and to make efforts advocating for our service recipients to obtain needed service and interventions (American Occupational Therapy Association, 2010). A practice that resorts to convenience and cost factors may not be serving the best interest of our stroke patients. Considering the high prevalence of stroke conditions and the importance of arm functions, occupational therapy practitioners are encouraged to advocate for patients by calling for increased research, stepping up their professional development education, and promoting the best practice available with increased assertiveness in the health care industry.

Our study has several limitations. Firstly, the sampling was limited within one organization whose membership represents only 15% of the registered California occupational therapy practitioners. Approximately 6% of the members and 8% of the OTAC's Spring Symposium attendees completed our survey, which further translates into approximately 1% of

registered occupational therapy practitioners in the state of California. Given this limitation, our survey study should only be treated as an early exploratory study. Thus the results can only provide us with a glimpse of the practice phenomenon in California, at best. Secondly, the study relied on a multiple-choice self-report survey. This method may not have captured the whole range of clinical reasoning employed in post-stroke rehabilitation. Lastly, these exploratory data on the use of shoulder sling should be interpreted with caution. The data were not based on the actual clinical records and relied on the assumptive calculation using midpoint range of the multiple choice answers offered in the questionnaire.

Conclusion

The study of the clinical reasoning in the use of shoulder sling is rare. Our study identified the practice tendency in the use of sling, clinical contexts where the sling is used, the most commonly used sling type, and the reason for its popularity. This glimpse into the practice phenomenon in California, as demonstrated by our survey, indicates that the clinical management may have been affected by the convenience and cost factors. Advanced education in post-stroke rehabilitation appears to have played a critical role in the promotion of better practice. Future studies are necessary to test the generalizability of the results from this study, especially the trend in our national and international practices. Further investigation into the role of professional development education will be highly beneficial since additional education may serve as a pivotal point that influences the occupational therapy practice phenomena.

Acknowledgements

The authors would like to express sincere gratitude to the Occupational Therapy Association of California (OTAC) for providing us invaluable research opportunity.

References

Ada, L., Foongchomcheay, A., & Canning, C.G. (2005). Supportive devices for preventing and treating subluxation of the shoulder after stroke. *Cochrane Database of Systematic Review, 1.* Art No.:CD003863. doi:10.1002/14651858.CD003863.pub2.

American Occupational Therapy Association. (2010). Occupational therapy code of ethics and ethics standard. *American Occupational Therapy Journal, 64*(6), S17-S26. doi:10.5014/ajor.2010.64517

Brooke, M., de Lateur, B., Diana-Rigby, G., & Questad, K. (1991). Shoulder subluxation in hemiplegia: Effects of three different supports. *Archives of Physical Medicine & Rehabilitation, 72*(8), 582-586.

Center for Disease Control and Prevention. (2011). *Stroke*. Retrieved from http://www.cdc.gov/stroke

Dieruf, K., Poole, J. L., Gregory, C., Rodriguez, E. J., & Spizman, C. (2005). Comparative effectiveness of the GivMohr sling in subjects with flaccid upper limbs on subluxation through radiologic analysis. *Archives of Physical Medicine & Rehabilitation, 86*(12), 2324-2329. doi:10.1016/j.apmr.2005.07.291

Foongchomcheay, A., Ada, L., & Canning C.G. (2005). Use of devices to prevent subluxation of the shoulder after stroke. *Physiotherapy Research International. 10*(3) 134-145. doi:10.1002/pri.3

Gustafsson, L. & Yates, K. (2008). Are we applying interventions with research evidence when targeting secondary complications of the stroke-affected upper limb. *Australian Occupational Therapy Journal.* 56(1), 428-435. doi:10.1111/j.1440-1630.2008.00757.x

Han, S.H., Kim, T., Jang, S.H., Kim, M.J., Park, S., Yoon, S.I., & ... Lee, K.H. (2011). The effect of an arm sling on energy consumption while walking in hemiplegic patients: a randomized comparison. *Clinical Rehabilitation*, *25*(1), 36-42. doi:10.1177/0269215510381167

Hartwig, M., Gelbrich, G., & Griewing, B. (2012). Functional orthosis in shoulder joint subluxation after ischaemic brain stroke to avoid post-hemiplegic shoulder-hand syndrome: A randomized clinical trial. *Clinical Rehabilitation, 26*(9), 807-816. doi:10.1177/0269211511432355

Hesse, S., Hermann, C., Bardeleben, A., Holzgraefe, M., Werner, C., Wingendorf, I., & Kirker, S.G.B. (2013). A new orthosis for subluxed , flaccid shoulder after stroke facilitates gait symmetry: A preliminary study. *Journal of Rehabilitation Medicine 45*, 623-629. doi:10.2340/16501977-1172

Kumar, P., & Swinkels, A. (2009). A critical review of shoulder subluxation and its association with other post-stroke complications. *Physical Therapy Reviews, 14*(1), 13-25. doi:10.1179/174328809X405883

Mendez, L. & Neufeld, J. (2003). Clinical reasoning: What is it and why should I care. Ottawa, ON:CAOTA publications ACE

Moodie, N., Brisbin, J., & Morgan, A. (1986). Subluxation of the glenohumeral joint in hemiplegia: Evaluation of supportive devices. *Physiotherapy Canada*, *38*(3), 151- 157.

Morley, A., Clarke, A., English, S., & Helliwell, S. (2002). Management of the subluxed low tone shoulder: Review of the evidence. *Physiotherapy. 88*(4) 209-217. doi10.1016/S0031-9406(05)60412-9

Pedretti, L. W., Pendleton, H. M. H., & Schultz-Krohn, W. (2006). Pedretti's occupational therapy: Practice skills for physical dysfunction. St. Louis, Mo: Mosby/Elsevier.

Roger, V., Go, A., Lloyd-Jones, D., Benjamin, E., Berry, J., Borden, W., & ... Turner, M. (2012). Executive summary: heart disease and stroke statistics--2012 update: a report from the American Heart Association. *Circulation*, *125*(1), 188-197. doi:10.1161/CIR.

Schell, B.A., & Cervero, R. M. (1993). Clinical reasoning in occupational therapy: An integrative review. *The American journal of occupational therapy*, *47*(7), 605-610.

Smith, R., & Okamoto, G. (1981) Checklist for the prescription of slings for the hemiplegic patient. *The American Journal of Occupational Therapy*, *35*(2) 91-95.

Stolzenberg, D., Siu, G., & Cruz, E. (2012). Current and future interventions for glenohumeral subluxation in hemiplegia secondary to stroke. *Topics of Stroke Rehabilitation 19*(5), 444-456. doi:10.1310/tsr1905-444

Vasudevan, J. M., & Vasudevan, S. V. (2008). Hemiplegic shoulder pain: Diagnosis and management. *Clinical Reviews in Physical and Rehabilitation Medicine. 30*(3) 207-220.

Williams, R., Taffs, L., & Minuk, T. (1988). Evaluation of two support methods for the subluxated shoulder of hemiplegic patients. *Physical Therapy. 68*(8), 1209-1214.

Yavuzer, G., & Ergin, S. (2002). Effect of an arm sling on gait pattern in patients with hemiplegia. *Archives Of Physical Medicine & Rehabilitation, 83*(7), 960-963. dio:10-1053/apmr.2002.33098

Zorowitz, R., Idank, D., Ikai, T., Hughes, M., & Johnston, M. (1995). Shoulder subluxation after stroke: a comparison of four supports. *Archives* of *Physical Medicine & Rehabilitation*, *76*(8), 763-771. Retrieved from http://www.archives-pmr.org

Table 1. Reason for the Sling Selection

		Orthopedic (triangular) sling	GivMohr sling	Rolyan sling	North Coast Hemi Sling	C.V.A. Sling	Harris Hemi Sling	Bobath Sling
Procedural reasoning	Based on the severity of the subluxation		10	1	1	2		1
	Based on the muscle tone	1	8	1	1	1		
	It gives better support for the arm	3	18	4	4	2	2	
	It gives better alignment to the glenohumeral joint		19	6	6			1
	It positions the humerus in external rotation		9	3	3			
	It allows for hand use	5	4	3	3	1		
Pragmatic reasoning	Physician prescribed it	22	3	1	1			
	Cost	20		2	2	1		
	The facility has stock	34	10	3	3	1		
	Has good vendor accessibility	5	2					
Narrative and Interactive reasonings	Easy donning/doffing	26	7	1	1	4	1	
	Patient's comfort	15	17	2	2	3	3	1
	Good appearance	2	5					
	Durability		4					
Conditional reasoning	Because I am familiar with this type of sling	9	6	3	3	2	3	
	Because I have success with this type of sling	7	14	4	4		1	
	Other	13	13	3	3			

Number of respondents = 134. The respondents selected multiple reasoning choices as applicable.