

Universal Assistive Perching Device for Bathroom Safety

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Abstract: To maintain the ‘independent living’ until the end of life, older people need to keep themselves from being ‘ill’ and ‘falls’. Among population aged over 65 years old in Taiwan, 37% of older people are in good health, 59% are in poor health, but can live independently [14]. In fact, older people want and hope to live independently. However, losing mobility is the main reason that causes older people being inactive, and is caused mainly by disease and falling [12]. According to statistics, one-third of older population experience falls every year [15], while 70% of falls are occur at Home, in which the bathroom and toilet is the most prevailing occasion [16]. This study analyzed the actions and postures of older people when using shower room. Problems were found including: losing balance, muscle weakness and posture difficulties. Through appropriate measures of ‘balance assist’ and ‘posture support’, these problems can be improved and then, accidents of falling should be avoidable. To achieve this goal, concept design to fulfill the requirements of ‘balance assist’ and ‘posture support’ has been done and was developed following the prospect of Universal Design. The proposed design was reviewed by an interdisciplinary team of design, engineering and humanity. The study on the feasibility was carried out aiming to objectively and rationally uncover the strengths and weaknesses of the proposed design and the resources required to carry through. As a result, a user experience prototype was made to support user centered research of the promising concept.

Key words: *universal design; balance assist; posture support*

1. Introduction

Among population aged over 65 years old in Taiwan, 37% of older people are in good health, 59% are in poor health, but can live independently [14]. In fact, older people want and hope to live independently. However, losing mobility is the main reason that causes older people being inactive, and is caused mainly by falling (20.5%) [12] and disease. According to statistics, one-third of older population experience falls every year [15], while 70% of falls are occur at Home, in which the bathroom and toilet is the most dangerous place [16].

For older people, bathing is one of the first basic activities of daily living [2]. However, chronic diseases and multiple co-morbidities may result in reduced functional ability because of a variety of different medical conditions [4]. Difficulties with bathing have been highlighted because a declining ability to perform this task is common among older people [8]. A diminished performance with bathing tends to precede difficulties before disability in other daily tasks [4]. In consideration of the above, enhancing independent bathing is an important

subject. It will need to focus on the restoration and maintenance of independent bathing in older people, and provides physical and psychological assistance.

2. Shower Stool for Healthy Older People?

There are many older people shower assistance product. It is hard to finish shower smoothly because older people are obstructed circulation by the shower stool when they take bath. Many older people use that to assist showering, but they cannot twist on the chair and they must sit to stand again and again. On the other hand, we found many shower stools designed as the normal chair height (table.1). While older people use shower stool, they repeated sit-to-stand or stand-to –sit as the reason why their Centre of Mass shift the bigger range than still standing. These situations involve reasons which can increase fall risk of older people in shower room. Besides, it is easier to stand up on high stool than normal height stool for older people or people with disabilities. Chaffin and Andersson (1994) state that a gesture have more flexible for STS which called 'semi-stand', the gesture between sit and stand, (Figure.1) and this gesture can prevent falling on the stool. High stool provide older people temporarily leaning and relax. Furthermore, high stool reduce 60% knee joint loading and 70% Hip joint loading in the move of sit-to-stand [11].




Type	square shower stool	cornor shower stool.	hand grid shower stool
Picture			

Table.1 existing shower stools designed as the normal chair height



Figure.1 semi-stand posture

3. Keeping Balance While Taking Shower

Standing upright while taking shower requires effort of motor coordination for maintaining a balance posture. Either a handgrip or a body support mechanism provides the shower user with balance assistance. Handgrip is the

most common assistive device for keeping balance in a shower room. However, it is not always the case with at least one hand free for handgrip.

Balance is technically defined as the ability to maintain the center-of-gravity (COG) of an object within its base-of-support (BOS). Posture is the stereotypical alignment of body/limb segments. Standing (static), Walking - running (dynamic), Sitting, Lying and Lifting. Relationship between balance and posture, postural alignment (and the changes/adjustments made due to perturbations) is the way balance is maintained. If this relationship isn't maintained then a system will be unbalanced [7].

Balance is a continuing physical activity. Balance and stability is a result of interaction of many variables, including Musculoskeletal System, Goal/Task Orientation, Central Set, Environmental Organization, Sensory organization and Motor Coordination. So, Balance and stability is a very complex system. (Figure 2 [7])

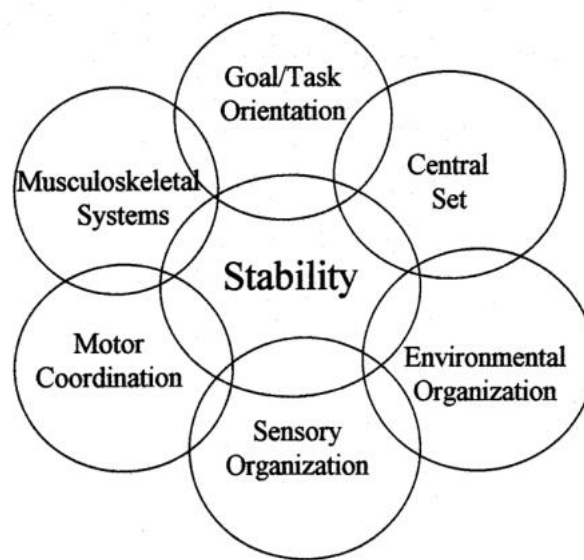


Figure 2 systems model of balance
Source: McDonough, Andrew L. 2000

Balance is a difficult problem for the older people. Aging usually refers to a body structure or function is degradation. Degradation of mobility affects the balance of the older people, mainly manifested in Sensory organization; musculoskeletal systems; strength and gesture [13]. In bathroom, older people need to close eyes when shampooing. Individuals with vision loss are at an increased risk of falls [10]. Physical exertion increases falls probability, because the older people need to twisting body and crouched many times during their shower.

4. Lean for Balance

It is known that bathing is a frequent activity of daily living, but it can be dangerous. Bathing involves sequences of movements in the bathroom with hard, slick surfaces that become slippery when wet, and falls may

occur. Naik et al. (2005) indicated that the most common mode of bathing is showering (In older person, 84%). Showering includes eight bathing subtasks including obtaining and using supplies, taking off clothes, turning on water and adjusting the temperature, getting into the bathing position, washing whole body, leaving the bathing position, drying whole body, and getting dressed [8]. Those involve bath transfer between sequences of movements that demand a considerable degree of strength and coordination from both upper and lower body. Losing balance in bathing is common, especially when there is lower body moving actions.

Bathing is a complex task and consists of sequential subtasks that increase the degree of freedom of movement and further complicate the task of maintaining balance. To perform movements and assume a certain posture, the basic condition is to ensure the stability of the body. There are two main balance strategies for bathing.

Firstly, hand grip is the most commonly reported feature used during the bath transfer [1]. If the grip is sufficiently strong to withstand the forces that act, grabbing the hand grip makes postural control relatively simple because it provides stable support. However, in the showering process, many sequential subtasks such as picking up a towel on the floor, hair washing and washing the lower legs, require both hands. Nevertheless, holding the hand grip may cause users lose some of the freedom in movement.

Secondly, a body support device offer a bracket function to be lean on. Leaning on a body support device provides the user with a simple support and preserves freedom of rotating the trunk and limbs. With the body support, the shower user should be able to overcome the destabilizing moments and reduce energy consumption.

5. To Integrate Perching Device and Handgrip to One Piece

“Perch” means to lean on an object in a short term, such as the action bird temporary perching on the branches. While “perch seat” usually refer to those seat available to be taken shortly. It’s a common way to provide passengers with a utility device for temporary leaning on. A perch seat occupies limited space and is easy to use. A perch seat is particularly suitable for bus station, waiting zone in subway, standing area in cars or trains and smoking area (table 2). It is not unusual to see perch seat designs in public. However, the perch seat is still not common in domestic space.





Type	subway exit	train cars	waiting zone in tube	bus station
Picture				

Table2 existing perching seats

In the bathroom of our home, there is still the timing we need this design. According to report, the height in shower space would be suitable among 65 to 70 miters. [13] Besides, if we integrate perching device and hand grip to one piece, it make the seating assistance devices easier to install in bathing space and higher acceptance to the older and other family members. The one piece design can help older people keep balance while they walk,

stand. And when they are doing shower activity, they can lean on the device instead of using shower stool to keep them balance and posture stable. Since it provides what human needs while standing, it’s not only a shower stool anymore. Instead, it can be used by all family members. Older people would not feel embarrassing or uncomfortable when using it.

6. Results Analysis and Discussion

In this study, based on the literature review and analysis, we suggest the Universal Assistive Perching Device for Bathroom Safety design. This design is based on the handrails functional to combination height sitting and the balance lean. Therefore it can make the older people lean on and keep balance when they taking bath and changing posture. This design were designed, in accordance with universal design principles, to avoid attaching a stigmatizing “disability label”, and can be applied to a wider use of ethnic targeting.

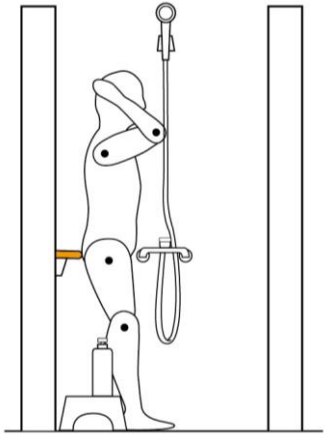
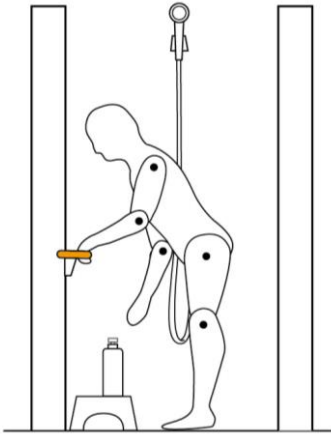
leaning on the assistive perching device for balance with hands free	using the assistive perching device as a handgrip when bending the trunk for lower position tasks
	

Table3 universal assistive perching device for bathroom safety

7. Examples Citations

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