Design of Hybrid Rollator cum Walker for Elderly: Review on Literature

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Abstract: Moving independently creates a sense of freedom and confidence among people with a walking disability. The advances in walkers have been enormous and shown a great help on existing people with walking difficulty. But there is a need to investigate and improve existing walkers in the context of ergonomics, design, and evaluation of walkers aided with assistive technology. Besides, it describes problems related to walkers and future advancement to improve the traditional walkers according to the need of society.

Keywords — Walker, Rollator, Design, Technology, Mobility

1. INTRODUCTION

Walking disability not only reduces the self-confidence and make the elderly people depend on others for their daily life work. According to data from World Population Prospects: the 2019 Revision, by 2050, one in six people in the world will be over age 65 (16%), up from one in 11 in 2019 (9%). By the end of 2050, one out of four persons residing in Europe and Northern America could nearly touch the age 65 or over. In 2018, for the first time in history, persons aged 65 or above outnumbered children under five years of age globally.[12] The number of persons aged 80 years or over is projected to triple, from 143 million in 2019 to 426 million in 2050. There are various types of walker which are available, and they are mainly of three types.

1.2 Basic Walker (without wheels)

This type of walker is commonly used, and it is available for sustaining heavy weights. These are best used on indoor surfaces. Since doesn’t contain any wheels, these types of basic walkers provide almost stability for those who need a little extra help for mobility.

1.3 Two-Wheeled Walkers

These walkers contain wheels for easier mobility and ease of movement outdoors, wheeled walkers are categorised as those walkers having two wheels at front. These wheels are often fixed, meaning they do not swivel side to side. Wheeled walkers are a good choice for those who needs extra stability but want to be traversing through uneven terrain.

1.4 Rollators

These walkers contain wheels on all its four legs. It offers the greatest ease and range of movement. many models offering swivel wheels and hand brakes to increase control on walker. Rollators with larger wheels offer the most mobility. Rollators are often equipped with seats and baskets for helping user to socialize easily without any worry of carrying the items.
Fig. 1 Basic Walker [2]

| Advantages | a) Anti-skidding rubber foot pads and metal slice inside which make it durable  
|           | b) gears for height adjustment  
|           | c) bear a significant amount of weight  
| Disadvantages | a) it obstructs walking  
|               | b) with every set it needs to be lifted  
|               | c) low mobility  
|               | d) d) chances of toppling  

Fig. 2 Two Wheeled Walker [2]

| Advantages | a) The handles increase the stability while standing or sitting  
|           | b) A single release folding mechanism is designed to aid users with limited hand dexterity.  
|           | c) Can be used as a portable toilet safety frame  
| Disadvantages | a) less stable as compared to traditional walker  
|               | b) needs little training before handling  
|               | c) the front wheels do not rotate  

Fig. 3 Rollators [2]
### Advantages

- Flexible backrest for comfort.
- Ergonomic hand brakes lock the rear wheels for security.
- Flip-up seat with built-in handle.

### Disadvantages

- Roll away from a patient.
- Needs good abdominal strength for manoeuvring.
- Brakes failure may happen.

#### 2. Literature Review

**M. Le and E.-C. Jung**[^1] suggested a three-wheeled modern design which can be used for climbing stairs also, the frame angle can be adjusted according to the height of the stairs. Its modular design gives a psychological comfort to the patients. If mass-manufactured, then this product can be cost-effective and widely used in a smart city.

**F. Nickpour and C. O’Sullivan**[^4] found out that many of the features and components of different walking aids are similar and can be rearranged to form various better walking aids. Their focus was on the design to be more accessible and less costly. Design principles on which the foundation is laid is affordability and evolvability.

**Nurul Ariff Ah Binti Hamidi**[^5] gave the design procedure of his 4 different concepts and distinguish between major advantages and disadvantages of four concept designs by switching base as flat, rubber, and changing heights.

**Merlet, J.-P. (2010)**[^6] provide design for ANG walker cum rollator for elderly. ANG uses a clutch system based on a computer-controlled bistable spring electromagnet that allows us to engage and disengage the motors through an Oldham coupling. For automatic stabilization, ultra-sound sensors were proposed which detects falling motion and actuates the recovery action and prevents falling.

**R Aanslow, J Spicer BA et al**[^7] experimented on thirty patients under the actual living conditions. Rigorous testing was done on various commercially popular walking aids to check stability. Results show that there is no significant difference in terms of stability in the two-purpose frames. However, a patient's word suggested that the frames with rear ferrules were difficult to use compared to the ones without it. None of the walking aid was found to be perfect and hence different walking aid depending on the environment should be used.

**Gerard Lacey, BAI, MA, Ph.D. and Shane MacNamara, BA**[^8] The study was based on the design and evaluation of smart mobility aid for visually impaired or elderly people with walking issues. This was a prototype-based study and some prototypes were made to analyze and improvise the design. Various sonar and infrared sensors were used to acquire information and navigation purposes. **Concept Prototype** - The user input was captured through a joystick and two switches. The user feedback was through recorded voice messages and tones.

**Ahmad Muammar Bin Md Yasin, Lim Wei Liong, Patrick S. K. Chua*, Zheng Jianxin**[^9] proposed a new design of walker which is handier, compact and user-friendly. This smart walker has features that monitor the patient's movement. In this paper, first of all, the previous design is considered, and their cons are removed in the new design.

**Margaret P. O’Hare, Shona J. Pryde*, Jacqueline H. Gracey**[^10] reviewed the evidence for the provision of walking frames to improve mobility for older people. The study covers various types of a walking frames to analyse it and suggest the process of prescribing. The effectiveness in terms of mobility is also calculated.

**Stevens JA, Thomas K, The L, Greenspan AI**[^11] this study is based on unintentional falls of walking aid users. Walkers can cause as many as seven times the injuries recorded by canes. The falling ratio is more in women in comparison with men. The study results suggest that more research is needed to improve the design of walking aids.
Evaluating the works that were presented in this article, one can infer that walking aids i.e. walkers are most beneficial for the rehabilitation and assisting purpose. but in a few areas, this traditional walker can be improved such as

1. Modular design which is easy to be operated and produces less strain to the arm which reduces the effort required for walking.
2. Stability of walkers is a big concern since toppling is a major factor of among the existing traditional walkers.
3. All the walkers used are mainly concerning the old elderly but not for visually impaired elderly and patients subjected to memory losses. In this place, technology can produce a major shift in these people's confidence.
4. Most of the walker's available works on only one purpose i.e. Only walking but no as such system for sitting while prolong walking or standing.

REFERENCE

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