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Evaluation of important factors in accepts or reject of upper limb prosthesis in children

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Abstract

Introduction: upper limb amputee Children usually uses prosthesis for better function. But studies show a high percentage of rejection of the prosthesis in this group. In clinical studies, there are not very different in function of children who use of prosthesis and those who do not. Answer to why children accept and use their prosthesis or reject it could help and improve the future design of the prosthesis and rehabilitation. The aim of this study was finding important criteria for children with below elbow amputation, their parents and therapists for acceptance and use of prosthetics or rejects it in children group. Method: This study was conducted by literature search of Science direct, Google Scholar, Cochran Library, MEDLINE and PubMed between 1966 and 2014 ,that investigated effective factors in accept or reject of below elbow prosthesis in below elbow amputee children.For quality assessment of articles we rated each paper using the Downs and Black score ranges and Pedro scale . The two reviewers independently read and classified the articles by population, type of study and results. Results After initial evaluation and reviews, 14 articles were included in this study. Most studies were reported form and questionnaire and clinical observations.The general characteristics of the prosthesis, prosthesis control method, quality of life, family and the rehabilitation procedures were important factors were explored in these literature. Conclusion According to the studies, it is necessary to optimize the prosthesis according to the real children expectations and needs to improve their quality of life.There are controversial studies about performance and first time prosthesis in children but studies confirmed that Group therapy can increase the acceptance rate of

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prosthesis. Training and finding ways for function without prosthesis along using it to communicate with the environment, increase motor control and sensory perception that could increase accept of prosthesis in children.

Keywords: upper limb prosthesis, children, amputation

1. Introduction

The main reason for not forming upper limb caused by congenital defects that usually appears with defects in other limbs. Other main Causes include trauma and tumors. Congenital below-elbow deficiency affect between 19.5 to 21.5 per 10,000 live births [1]. The exact number of upper limb amputee children in Iran is not available but in other countries, the data show that most amputation in children is below the elbow and in left side [2].

Children with such defects usually use of prosthesis to improve performance and prevent further complication but researches indicate that a high percentage of rejection of the prosthesis in this group that is approximately 10% to 49% [3]. Despite the efforts of designer and families, many children do not use of the prosthetic also there is not significantly different states between children who use of prosthesis and they are not used, One study in 489 children with upper limb amputations reported that approximately 34% of these children do not use of prosthesis or not accept it and the main reason for the rejection were dysfunction and no comfort of prosthesis [3]. In other studies functionality, simplicity, the appearance and social acceptance were important to considereation for proper design of children prosthesis [1, 2, 4]. Assessment that why children reject prosthesis and not used it could help to prosthesis designer or improve rehabilitation programs. The purpose of this Systmatic review is a descriptive analysis of the literatures with subject of children with below elbow amputation and assessement of children, parents and therapist recommendations in relation to accept or reject of upper limb prosthesis in these children. The main research question is What's the important factors in accept or reject of prosthesis by children, parents and therapists and Which eventually led to satisfaction and dissatisfaction of the prosthesis. Children are not the small adults [2], so their needs in assistive device and prosthesis must be considered as a distinct group.

2. Material and Method

2.1. Research strategy

In this study the published articles in field of “upper limb prostheses in children” from 1966 to 2014 were reviewed. The following databases was searched for articles: “Science direct; Google scholar; Cochrane Library; Medline; Pubmed and ISI web of science. ”The keywords “upper limb prosthesis". "Upper limb extremity", "hand prosthesis", "upper limb deficiency” and “upper limb amputation” in combination with the words "children" and "infant" was used for research also, some of the refrences in articles were evaluated. The abstract and title of papers were evaluated based on selected criteria.

2.2. Selection criteria

Selection criterias for inclusion to this study limited to researches in field of below elbow prosthesis in children who used passive, body power or myoelectric prosthesis. In these articles, important factors for accept or reject of prosthesis were prescribed by children, parents or therapists. Figure 1, shows a diagram of study selection. In initial review of titles and abstracts, 160 articles was selected and at last 14 articles were selected after a review of the literature by inclusion criteria of research.

3. Quality Assessment

All the articles in terms of quality and methodology were rated separately by two investigators. The quality of the papers was evaluated based on “Down the Black tool” [6]. It is a valid test for assessing

the quality of a systematic review and the PEDro tool was used to ranking papers [6, 7]. PEDro contains 11 questions with a maximum score of ten [7, 8] for grading, score of 5 or less, according to the article of Foley et al (2006), was considered as a poor quality of Randomized Controlled Trial [7] The final score for each article was with agreement of two authors. The relationship between test scores obtained by Pearson correlation test in Spss software version 17.

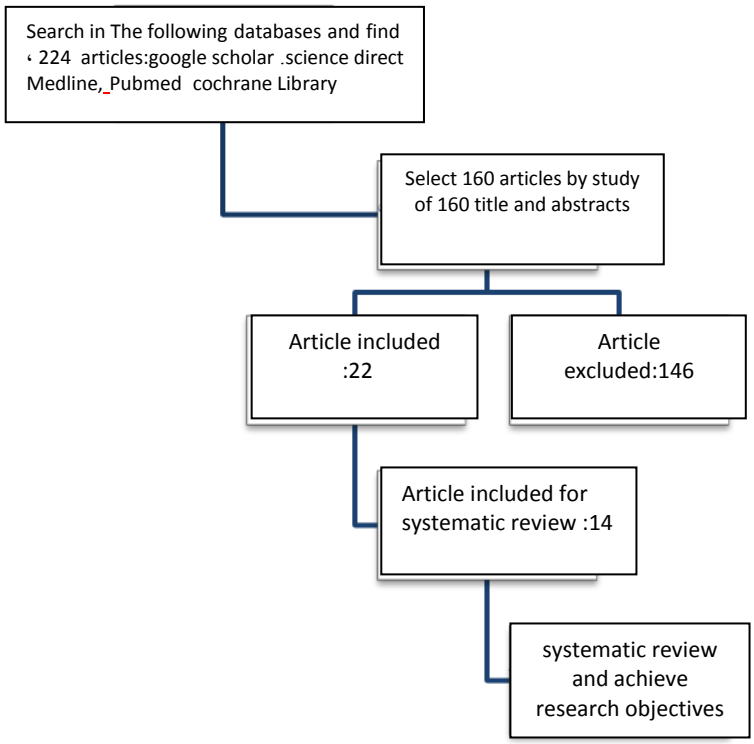

Figure 1. Flow chart of literature search for Evaluation of important factors in accept or reject of upper limb prosthesis in children

4. Results

This study is based on the study of 160 articles and discriptive analysis of 22 selective articles, that at last 14 articles included in research. Summary of descriptive analusis of included articles classified in Table 1. In table 2 also there are lists of the methods to evaluate the quality of the articles on the base of down and black check list that indicates, the reporting, external and internal validity, and total scores [6]. Ranking of the articles in this section were 3 to 8, 1 to 3, 2 to 5 and 2 to 5, respectively for any items.

Table 1. summary of included studies

Results:	method	Participant description	Author, year (ref.)
Reasons for rejection of prosthesis are, high confidence and ability of activity without prosthesis .cosmetic and structure of prosthesis were important factors for choose a prosthesis.	online focus group interviews.Data were analyzed using the framework approach	42 children of 8–12 year old y/o adolescents ; 13–16 and 17–20 y/o, 17 parents, 19 healthcare professionals participated in study.	Vasluian 2013 (ref.1)
Early prosthetic fitting is valuable in accept of prosthetic.Cosmetic is important for children in specific age	Case record and questionner	131 children with upper limb deficiencies were Studied	SCOTLAND, 1983 (ref.5)
The reason of rejection of prosthesis was inability of prosthesis in function and structural and control problem	Multi center cross sectional study Questionner ، and open end questions	489 children (2- 20 y/o) with unilateral congenital below elbow amputation and parents	Wagner 2007 (ref.3)
Uncomfortable harness and poor cosmetic were a close first and second for negative feature of arm prostheses .	questionner	30 amputees (7 children) and their therapists	LeBlank 1985 (ref.8)
Most of the children with unilateral congenital deficiencies had received passive prostheses as their first prosthesesand body power as their second. Children with acquired defects usually had active prostheses.	Interview and Medical record	224 children, with unilateral congenital and aquaired deficiencies	Kuyper 2001 (ref.9)
Training is related to successful use of the prosthesis. The drop-out in preschool children is very low compared to adults. technical failure, breakdown, or fitting problems were reasons of temporary rejection	A specially designed questionnaire	41 children with unilateral upper limb deficiency that use myoelectric prosthesis	Egermann 2009 (ref.10)
Children fit with a below elbow prosthesis at younger ages wore a prosthesis longer than children fitted at older ages. Type of prosthesis and area of living are effective in duration of using of prosthesis .	retrospective chart review-interview	298 children with unilateral upper limb deficiency	Tokeshi 2005 (ref.11)
voluntary opening body power prosthesis is not sufficient to greep for children	Experimental study - electronic dynamometer with force transducer	37 limb deficient Children congenital, trans-radial limb deficiencies.	SHAPERMAN 1995 (ref.12)
wearing a prosthesis can help doing only special sports or function. Although it is possible to fit a special sports device onto a prosthesis,it is (too) expensive	A qualitative study using online focus group interviews	42 children with unilateral upper limb, deficiency 17 parent and 19 normal subject	De Jong 2012 (ref.13)
Unilateral children amputees may choose multiple prostheses on the basis of function and the most functional and simple prosthesis in the long term design.	long-term follow-up questionnaire	34 unilateral below-elbow amputees children	Crandall 2002 (ref.14)
Prostheses may help with social acceptance or as tools for specialized activities, but they do not appear to improve function or quality of life, functionality of prosthesis is not acceptable.	A multicenter outcomes study-The Unilateral Below-the-Elbow Test (UBET)	489 unilateral below-elbow amputees children	James 2006 (ref.15)

Initial fitting before 1 y/o was related to use of a prosthesis for at least 4 years.Age at first fitting was not associated with satisfaction with the prosthesis, functional use of the prosthesis or motor skills.	The Satisfactory Inventory the Prosthetic Upper Extremity Functional Index - Videotapes	20 children with congenital upper limb amputation between 6to 21 y/o	Huizing 2010 (ref.16)
The role of parents in the acceptance prosthesis is very important. Learning to operate prosthesis in children is better in the group.	questionnaire	12 Children with congenital, trans-radial limb deficiencies	Datta 1998 (ref.17)
Rejection within 3.5 years and after 13.5 years of prosthetic use is more, that relate to puberty. Fitting before the age of 2 years seems to reduce rejection rate.	Cross-sectional study of a cohort questionnaire	22 children (0-18 years) with a unilateral congenital arm defect and parents	Postema 1999 (ref.18)

Table 2. Quality assessment of included studies by Downs and Blak check list

Total score	selection bias	Internal validity - bias	External validity	Reporting	author	refrence
16(fair)	4	4	1	7	Vasluian et al	8
20(good)	5	5	2	8	SCOTLAND et al	4
20(good)	5	5	2	8	Wagner et al	7
12(poor)	3	3	1	5	LeBlank et al	99
19(fair)	5	4	2	8	Kuyper et al	10
3(poor)	3	3	1	6	Egermann et al	11
21(good)	5	5	3	8	Tokeshi et al	12
17(fair)	4	4	2	7	SHAPERMAN et al	13
21(good)	5	5	3	8	De Jong et al	14
20)good(	5	5	2	8	Crandal et al	15
21(good)	5	5	3	8	James et al	16
20(good)	5	4	3	8	HUIZING et al	17
10(good)	2	2	1	5	DATTA et al	18
20(good)	5	5	3	7	Postema et al	

Downs and Black score ranges were grouped into the following 4 quality levels: excellent (26 to 28), good (20 to 25), fair (15 to 19), and poor (less than 14).

5. Discussion

In this study after investigate of the study articles we found that function and control system, children condition, rehabilitation and family, early fitting of prosthesis and quality of life were total important factors discussed by children, parents or therapis that is discussed at below.

6. Function and control system

The performance and appearance of the prosthesis are important factors for accept. In this study, appearance of prosthesis even about function of prosthesis is very important factor for choosing a prosthesis by children and parents. [1,9,12,14,15], also the prosthesis can be reject by the poor performance, heavy weight, poor quality and lack of sensory feedback,battery discharge, motor problem and need to continiual maintenance (1,10,16,19.19). The most of the children believe that the prosthesis, don,t help to normal function and the recreational activity [3, 4].

7. Children condition

Age of early fitting, stump lenght and status and the physical and mental condition in children influence in accept of prosthesis. Child's high self-esteem and a sense of inability with the prosthesis cause rejection of prosthesis in some children.One study showed that children managed to function perfectly well without prostheses even are independence and doing good work [1]. However, certain activities such as lifting or some sports were not performed without prostheses by several young adolescent [8] children with long stamp usually are not a good candidate for use the prosthesis due to the high function and proprioceptive into the children with short stamp [8,9,10].

8. Rehabilitation and family

One factor is a good fitting and alignment by expert prosthesists. A multidisciplinary rehabilitation team consisting of paediatric orthopaedic surgeons, prosthetists and occupational therapists accompanies the family during the rehabilitation program influence to the acceptance of prosthesis by children. Egermann (2009) concluded in this study that myoelectric prosthetic use training by an occupational therapist is related to successful use in children in 2 to 5 years [11]. Prosthetic use training is best in form of the games and before the child is tired. [1] also the role of parents in choice and acceptance of the prosthesis is as important as a child and they usually preffer the cosmetic passive prosthesis [1]. Also the role of parents and their guidance in the acceptance of body power and electronic prosthesis by children is very important [17, 18]

9. Early fitting of prosthesis

Proper age for early fitting of Upper limb prostheses has been discussed in many studies and depend on Prescribed by a doctor or therapist. Parents believed that rapid administration of a prosthesis for the body image, balance and symmetry, acceptance and performance of children is important [8]. In some clinics early fitting is at the age of six months to support the sitting and crawling them [10]. The Scotland (1983) showed that the greatest acceptance of the prosthesis is under the age of two years and before enterance to school and 50% of children with unilateral amputation, use prosthesis after the age of two and 22 % use earlier [5]. In Wagner study (2007) on 489 upper limb amputee, data from 110 subject who reject prosthesis use, showed that "58% had been fitted befor age 1years of age and 18% had been fitted between 1 and 2 years of age" because of uncomfortability and not help to function. In another study Huizing (2010) concluded that prosthetic fittingt before 1 years age, leading to a longer use of prosthesis (more than four years), but does not improve motor behavior [16]. Some study showed that children in certain phases of the life (for example maturation) trend to reject of prosthesis [5, 9, 18]. Scotland (1995) concluded that highest prosthesis drop-out rate was at the age of 13 years when the children became more sensitive to cosmetic appearance [5].

10. Quality of life

The primary expection and purpose of the amputee who use of Prosthesis is improve the quality of life [10]. For children with unilateral congenital below-elbow deficiency, prostheses appeared important for social integration more than functionality [1].

11. Conclusion

Prescription of upper limb prostheses for children requires special considerations [3]. This study shows that overall there is a need to optimization and improves the performance of the prosthesis for children and design of specific Prostheses and assistive device for daily work and recreation that could raise the percentage of acceptance of prosthesis in children. In this regard it is essential for prosthetic designers to Re-evaluate of the real role of prosthesis for improve the quality of life according to the

expectations of the children and age. It should be noted that the Prostheses only will be accepted by children when it is a real assistance to help them and improve quality of life [20] The prosthesis acceptance by the children and family could raise by direct contact with the therapist or the same group as group therapy and training techniques and children education of alternative functional methods without the use of prosthetic [1,3]. Therapists should be aware of new prosthetic rehabilitation and technique to help this group [4, 8]. Also design and use of quantitative and more accurate measurement tools to measure the performance of the prosthesis and the patients is necessery, specially for assessement of proper age for use of prosthesis in children. Early fitting of prosthesis, increse acceptance and tolerance of prosthesis and improve functionality [5, 19].

Overall this study showed that the structure and performance of the prosthesis and control system, quality of life ,prospect of family , time of prescription, and proper rehabilitation and training at the right time are important factors and ultimately led to the acceptance and satisfaction or rejection of the prosthesis. Optimization of the appearance, materials and control system and increased sensory feedback device in prosthesis, proper training along with similar groups and the use of a prosthesis with multiple performance can enhance the acceptance of the prosthesis. It should not be forgotten that for increasing sensory and motor skills in children it need to some training and strengthen the activities and alternative methods without the prosthesis. Children are not the small adults [2], so and prosthesis rehablitation for them must be considered as a distinct group.

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