

Design concept of adjustable cane-chair for elderly in virtual environment

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Abstract : There are very rare research paper on elderly people in India though the elderly population is noticeable of overall population. The author of this paper has give a try to describe a new design concept of walking adjustable cane chair for the uses of elderly person. A stick or cane is one of the necessary things used by elderly in their daily life. A walking cane chair can be treated as a good aids for elderly uses in their daily life. The skeletal system or the biomechanics of elderly person is different from the normal people. So the existing cane chair couldn't provide much safety, comfort, flexibility for the use of elderly. This paper describes a new design concept of cane chair suitable to use by old age people. For this case study are done to collect the anthropometry data of elderly people. Then the product was created in virtual world using CAD software. The product is evaluated using Digital Human Modelling simulation.

1 Introduction

The report has written on considering elderly people. Worldwide the number of elderly population is increasing so there is a need to focus on this group of people. Elderly people's anthropometry body dimension is different than that of younger adults' so product designed for them should be ergonomically suitable for them. Due to their physical limitation many elderly use walking cane. For the same reason they are unable to do activity for long time. They need rest in interval of doing work, activities or posture. So for this study modification in existing walking cane model according to elderly people requirements is chosen. Considering above mentioned two factors walking cane should be newly designed with sitting facilities.

2 Problem With existing cane chair model

The existing cane chair model is not preferable for use of elderly persons because it does not provide much safety and flexibility .The body mechanics of elderly persons is also different from others. So they are not comfortable while using the existing cane chair. It also very difficult to carry it while going for out side due to its heavy weight and bulky size.

3 Aim and objective

A new design concept for walking cane chair especially uses for the elderly person is described in this paper. The walking cane chair described by the author of this paper is special use of elderly people and it eliminate all the drawbacks of existing cane chair.



4 Methodology

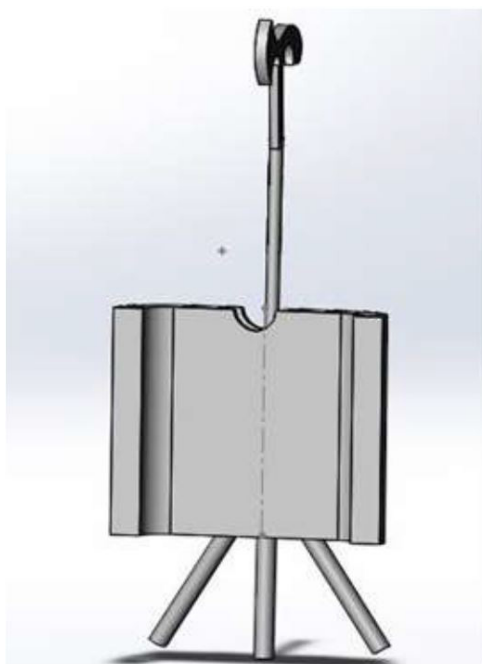
To know the problem of elderly people with the existing cane chair case study was done by the author in near by villages of IIT-Guwahati. The Case study includes the anthropometry observations of fifteen both male and female elderly persons. Most of their ages are more than 60yrs. Then different percentile of like 5th, 50th,95th were obtained using MS-Excel software. By Considering the data the CAD model of walking adjustable cane chair were created by using SOLIDWORK software. The manikins of the given percentile were created by using CATIA software to evaluate the product-human interface through digital human modelling. The product was modified accordingly to the manikin. The postural analysis of the manikin was done by using RULA analysis in CATIA software.

Table 1 Anthropometry data of the male elderly persons

	Min	Max	Mean	SD	CV	5th	95th	1	2	3	4	5	6	7	8	9	10	11	12
upper lumbar height(113)	20	29	24.25	2.99	12.32	19.33	29.17	25	27	29	29	22	23	26	24	23	21	20	22
elbow rest height(116)	15	18	16.50	0.90	5.40	15.01	17.99	18	15	17	17	17	16	16	16	16	16	16	18
waist width(117)	19	25	22.42	2.31	9.00	18.88	25.96	20	22	24	25	19	22	25	23	19	22	24	24
knee height (119)	42	54	46.41	5.31	7.13	40.97	51.83	46	42	45	54	45	44	48.4	48	48.5	50	43	45
buttock to popliteal(127)	32	46.4	39.49	6.32	10.93	32.39	46.59	42	34	35	41	32	38	37	48.4	42.5	43	40	43
buttock to knee(126)	42	51	47.63	2.92	6.12	42.83	52.42	46	49	45	50	42	44	48.5	50	51	50	46	50
hip breadth(137)	19	37	27.23	5.34	19.43	18.42	35.99	37	30	27.5	26	25	22	36	24	19	28	29	23
sub sternum height(9)	98.4	129.5	116.28	7.54	6.48	103.88	128.69	116	114	117.5	121	114	112.5	129.5	122.5	122	114.5	98.4	113.5
abdominal extension(11)	83.8	112	96.63	7.76	7.87	83.86	111.40	98	93	101.5	104.5	92	94.5	112	107	103.3	96	83.8	96
grip inside diameter(191)	4.05	5.1	4.57	0.35	7.59	4.00	5.14	5.1	4.8	4.15	4.75	4.05	4.5	5.1	4.75	4.5	4.5	4.15	4.5
middle finger palm inside diam	2.1	2.4	2.24	0.31	4.83	2.06	2.42	2.4	2.1	2.2	2.3	2.1	2.2	2.2	2.3	2.4	2.3	2.1	2.3
height	147.3	168.4	154.48	8.91	4.49	143.07	163.88	152.5	148.5	158	147.5	148.5	147.5	168.4	162.8	162.5	152.5	151	154
weight	41	72	53.04	8.47	15.95	39.15	67.01	53	51	59	49	51	47	72	56	41	42	56	60

Table 2 Anthropometry data of the Female elderly persons

	Min	Max	Mean	SD	CV	5th	95th	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
upper lumbar height(113)	20	27	23.00	2.37	10.32	19.09	26.91	25	21	20	26	20	22	27	22	21	23	24	25	24	24	26
elbow rest height(116)	16	19	17.21	1.09	6.00	15.51	18.91	17	19	19	17	16	17	17.5	16	17	16	18	17	17	17	16
waist width(117)	17.8	22	19.35	1.25	6.43	17.30	21.40	20.5	18	18	20	19	20	20	22	19.5	17.8	19.2	19.2	18	19	18.5
knee height (119)	41.2	48.4	44.88	3.37	5.28	40.98	48.78	47.5	48.4	45	47	47.5	44	42.5	43	42.5	41.2	46	44	44.2	43	44
buttock to popliteal(127)	36	44.3	39.19	2.53	6.44	35.04	43.32	41	36	37	44.3	38	41	36	40	38	37.5	40	41.5	39	40	38
buttock to knee(126)	39.8	49.5	44.48	3.01	6.78	39.54	49.43	49	48.5	44.5	49.5	46.5	39.8	41	45	44	42.5	43.5	42	40.5	46	44
hip breadth(137)	20	27.5	23.50	1.99	8.46	20.23	26.77	21.5	20	26	24	23	23	22.5	25	22	25	22	24	23	21	26
sub sternum height(9)	100	116	108.37	4.66	4.30	100.69	116.04	114	111	104.4	111	109	116	112	100	105	106	108	104	107.5	104.5	110
abdominal extension(11)	88	102	91.63	4.18	4.56	84.76	98.50	91	90.6	88	92	90	102	98	89.5	91	90.5	89	88	90.2	91	92
grip inside diameter(191)	3.8	4.75	4.36	0.33	7.09	3.85	4.87	4.75	4.5	4.5	4.75	4.15	3.8	4.15	4.15	4.15	4.15	4.75	4.5	4.5	3.8	4.75
middle finger palm inside diam	2.2	2.7	2.32	0.34	6.08	2.09	2.55	2.4	2.2	2.2	2.3	2.2	2.3	2.3	2.3	2.2	2.3	2.7	2.4	2.3	2.2	2.7



CAD model of walking adjust table cane chair for elderly

5 Result and Analysis

Digital Human Modeling feature of CATIA V5 R17 software is used for evaluating the final product with the digital human model. This analysis was done to make the product more ergonomically, digital human models are created according to the different observation taken from elderly people. The human model was fitted with the product and the product was modified according to the human model. At last RULA and POSTURAL SCORE analysis are done for evaluating the stress, force, center of gravity, comfort angle for good posture. The evaluation details are given below;

Fig 1



5th percentile
male manikin

Fig 2



95th percentile
male manikin



Fig 3



5th percentile
Female manikin

Fig 4



95th percentile
Female manikin

6 Conclusion

The product was evaluated with the digital human model and final score in RULA analysis is below 3 and it is green zone for all required posture in POSTURAL SCORE analysis, which shows the product is comfortable to use for elderly people. It can be concluded from above that the new modified walking stick is much better than the existing walking stick, because this was designed by considering best ergonomics and safety factor in design. The elderly people can take its special benefits by using in their daily life.

References

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