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Conceptual Design of Congregational Prayer Chair

Farouk Daghistani *

Faculty of Environmental Design, King Abdulaziz University, Jeddah, Saudi Arabia P.O. Box 80210. Jeddah 21589.

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Abstract

Sit-to-stand is regarded as one of the most mechanically demanding daily tasks. Because of body weakness or disability of some Muslims, they cannot assume all the required physical motions of prayers without relying on a conventional chair. However, using a conventional chair when praying in mosques may lead to two main problems: (1) Disturbing the worshipers in the row behind the chair and/or (2) causing the user of the chair to be misaligned with the row of prayer. In the present paper, a novel conceptual design for a congregational prayer chair that alleviates such disturbances and misalignment problems is addressed. First of all, the existing causes and patterns of using conventional chairs while praying in mosques are outlined. Secondly, design criteria for congregational prayer chairs are established. After that, a novel conceptual design for a congregational prayer chair is explained. The obtained results identified 15 existing causes and 18 patterns of using chairs while praying and 2 patterns of chair placement in the row of prayer. In addition, the results show that the most praying position chairs are used for prostration. This study reveals a key feature concept considered in the conceptual design of the chair to solve the aforementioned problems through constructing a predetermined moving seat pan and a seat back so that the user can attain whatever praying positions without changing the placement of the chair.

Keywords: *Chair, Design, Disability, Congregational prayer, Muslim.*

1. Introduction

Sit-to-stand is regarded as one of the most mechanically demanding daily tasks [1]. Unfortunately, difficulty with sit-to-stand motion is common especially among old people [2]. Today, there are different sit-to-stand devises that assist those people. Such devises are available commercially and include active supports (such as lift chairs, lift cushions and powered standing devices) and passive supports (such as grab bars and standing frames that assist stability when users rise) [3]. Despite the range of the various sit-to-stand devices, it is unclear which types of such devices are the most appropriate for persons who are in need for partial assistance [4]. In the particular case of Muslims, some people may need a suitable sit-to stand device that assists them physically to perform the daily prayers.

Indeed, Muslims are required to pray five times a day. They have to attain a particular set of body positions while performing their prayers. These positions consist of standing, bowing, prostrating, and sitting on the ground or floor for relatively long and short periods of time (Figure 1). They must be tranquil during every position, as tranquillity is one of the pillars necessary for the validation of the prayer [5]. Few seconds of stillness in each prayer's position are enough to achieve tranquillity [6]. Muslims, especially males, are encouraged to perform obligatory prayers congregationally because the reward is much greater than praying individually. Therefore, millions of worshipers around the world perform such prayers in mosques where the congregation is led by a person (Imam) and the remaining people stand behind him. The congregational prayer requires arranging worshipers' rows in a compact, straight and parallel manner with no gaps in the rows (Figure 2). Unfortunately, because of the age, illness, pregnancy, weakness or disabilities, or other temporary or permanent physical illness, many worshipers cannot assume all the required body positions. Hence, they may rely on a support structure (usually a conventional chair) for sitting while making gestures for the praying positions they cannot perform.

However, using conventional chairs while performing congregational prayer in mosques have at least two main disadvantages: First, the chair may disturb the worshipers in the row behind. Second, the chair user may be misaligned with the row of worshipers. Therefore, a large number of Muslim worshipers around the world would welcome a chair designed to alleviate the disturbance and misalignment problems caused by using conventional chairs. This kind of chair will provide an efficient support to attain all of the required prayer positions while praying in congregation in mosques.

* Corresponding author e-mail fdaghistani@kau.edu.sa.

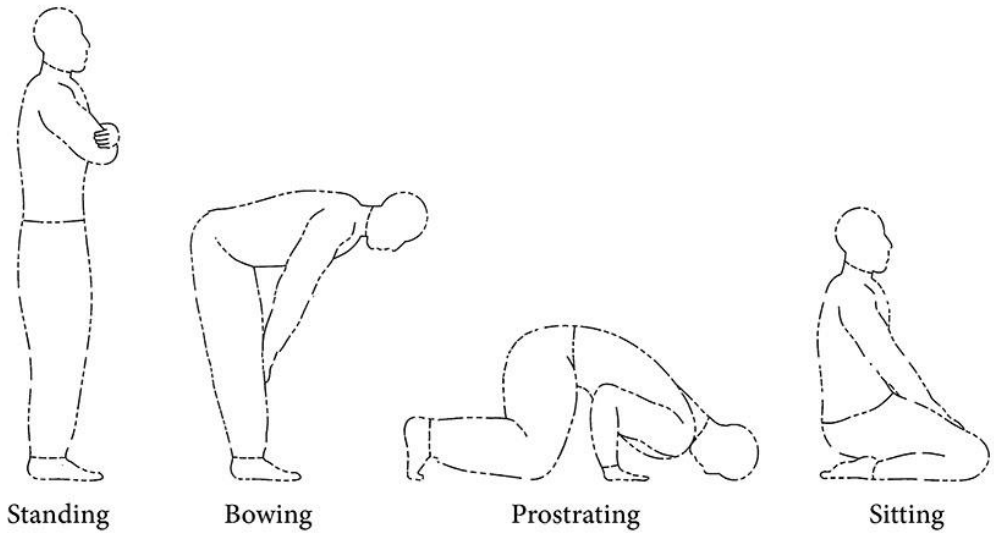

Figure 1. Body positions of praying.

Figure 2. Rows of worshipers in a mosque during a congregational prayer.

Ergonomics (or comfortable and functional design) is the scientific discipline and practice concerned with designing products that reduce fatigue and discomfort. Ergonomics takes proper account of the interaction between products and people who use them. In our case, the design optimization of a chair considers a number of factors including the shape, the width, the height of the seat pan and the backrest, the seat cushioning, etc. All these parts have the potential to influence comfort/discomfort of the seat users [7]. Low levels of seating comfort often lead to musculoskeletal complaints such as Low Back Pain (LBP) [8]. It is important to mention that many researchers revealed that setting for long time by itself doesn't increase the risk of LBP [9, 10, 11]. Therefore, it is essential to have a seat back that minimizes the spinal loading and relax the back muscles of the user. Such minimization and relaxation can be best achieved with a backrest inclined backwards [12, 13]. Chaffin *et al*. found that the stress on the spinal discs can be reduced approximately 40% by reclining the chair 20° degrees [14]. The seat back should be high enough to reach the shoulder blades and wide enough to support the waist breadth [15]. Another factor that enhances ergonomic seating is the inclusion of armrests. Nemoto and Ogawa found that the amounts of body flexion, hip moment, knee moment are all reduced when using armrests during standing up [16]. Armrests also support the upper body and so reduce spinal loading [17].

Cushioning and the seat pan design are important for comfort/discomfort when sitting for a long duration, as they affect the pressure distribution at the seat-to-user interface. Seats with firm cushions may be regarded as "sporty" while seats with soft cushions may be viewed as more "luxurious" [18].

Ergonomic seating incorporates also a range of adjustability, with controls that are easily to use especially when the chairs are shared among different people [19]. Lastly, and more comprehensively, ergonomic seating considers all of the activities the chair is designed to support (i.e., task seating) [20].

The relevant Islamic regulations in praying with the support of chairs were detailed by Muslim scholars. Here is a brief summary of the most important regulations:

- The worshiper who cannot stand when praying may pray sitting-down [21].
- Whatever the worshiper is able to perform, he/she is obliged to do so, and whatever he/she is unable to perform, is waived for him/her. For example if a worshiper is excused from standing, his/her excuse does not allow him/her to sit on the chair to bow and prostrate. Also, if he/she is exempted from bowing and prostrating, that excuse does not allow him/her not to stand and to sit on the chair instead [22].
- With regard to the placement of the chair in the row:

1. The one who prays sitting down from the beginning of the prayer until the end should have his posterior in line with the row because it is the place in which the body settles [23]**.** In this case, the rear legs of the chair must be aligned with the row (Figure 4-b).
2. The one who prays standing and sitting should level with the row when standing because what matters is the standing position [22]. In this case, the front legs of the chair must be aligned with the row (Figure 4-a).
3. When the front legs of the chair are aligned with the row, the chair will be behind the row, so it should be

placed in a manner that doesn't disturb the worshipers in the row behind, [22].

Based on the literature review of ergonomic seating, Islamic regulations mentioned above and the findings of a survey carried out by the author, this study aims to establish design criteria for a congregational prayer chair that solves the aforementioned problems. In addition, a proposed design for such a chair is presented.

2. Methods

A three-step procedure was used to achieve designing a new congregational chair that solves the aforementioned problems: (1) Defining the existing causes and patterns of using chairs while praying in mosques, (2) establishing design criteria for the congregational prayer chair, and (3) designing a prototype of the congregational prayer chair.

In the first step, the author observed chairs usage in mosques and conducted a short survey of 124 subjects (75 males and 49 females) who use chairs when praying or have used them when praying at least once in the past. The subjects' ages ranged from 18 to 95, with a mean age of 56.4 and a standard deviation of 17.8. The majority of the subjects (81.5%) were 41 years old and older (Figure 3). They were approached mostly at mosques by university students. The subjects were participated on a voluntary and not purely on a random basis.

The main purposes of this survey were to define the various causes of using chairs while praying in mosques and how the chairs were used. As the targeted population of this study is Muslims who use chairs when praying regardless of their ethnicities, and since it is impossible to design a chair that precisely fits the specific body shapes of all of them, the main challenge is to design a visually appealing and comfortable chair that suits the body dimensions of most users and can be adjusted to their specific needs [24, 25]. Therefore, anthropometric data related to the design of chairs which was collected in a study by M. AI-Haboubi have been relied on [26]. In the present study, 19 body dimensions of 408 subjects from 20 different nationalities were measured.

In the second step, the design criteria for the new congregational chair are laid-out based on the outcomes of the first step and relevant literature review.

In the third step, a prototype of the new congregational prayer's chair was developed based on the design criteria that came from the previous steps.

3. Results and Discussions

3.1. Existing Causes and Patterns of Using Chairs While Praying

Findings of the survey revealed 15 causes for using chairs while praying. Knee problems, aging and back problems were the three most common reasons and accounted for 50.8%, 42.7% and 35.5% of all cases, respectively. Pregnancy, foot problems, disability and extra weight were other less common causes with 5.6%, 4.8% and 4.0% of all causes, respectively. Other rarely mentioned causes accounted collectively for 12.1% include pelvis problems, heel problems, joints problems, accidents, varicose, sciatica, cirrhosis and surgeries (Table1).

Table 1. Causes of using chairs while praying.

Causes	No. of cases	Percent of Cases
Knee problems	63	50.8%
Aging	53	42.7%
Back problems	44	35.5%
Pregnancy	7	5.6%
Foot problems	6	4.8%
Disability	5	4.0%
Extra weight	4	3.2%
Other	15	12.1%

The results also identified 18 patterns of using chairs while praying, based on the various combinations of the five praying positions performed with the use of chairs (Table 2). The most repeated pattern is when the worshiper performs all of the praying positions while sitting down on the chair and gesturing. Such pattern is adopted by 29.8% of the study subjects. The second most repeated pattern is performing prostration, short sitting and long sitting praying positions with the support of chairs. Such pattern is adopted by 22.6% of the study subjects. The third most repeated pattern is performing bowing, prostrating, short sitting and long sitting positions with the support of chairs. Such pattern is adopted by 11.3% of the study subjects (Table 2).

Also, this survey revealed that prostration is the most praying position that the users of the chairs make gesture to, and that standing position is the least (Table 3)

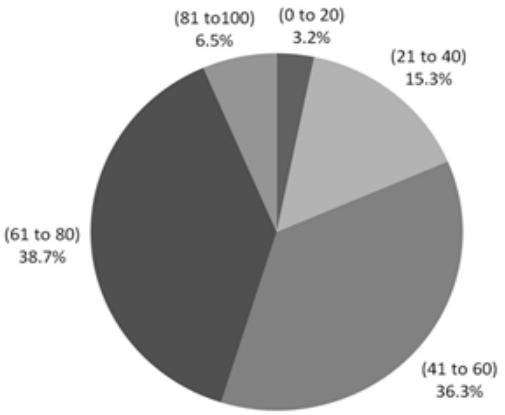

Figure 3. Percentage of the subjects in each age group of the study sample.

Table 2. The 18 patterns of using chairs, based on the various combinations of praying position(s) where chairs are used.

Pattern	No. of cases	Percent	Standing	Bowing	Prostrating	Short sitting	Long sitting
1	37	29.8%	x	x	x	x	x
2	28	22.6%			x	x	x
3	14	11.3%		x	x	x	x
4	8	6.5%		x	x		
5	6	4.8%				x	x
6	6	4.8%			x		
7	4	3.2%	x	x	x		
8	3	2.4%	x	x			
9	3	2.4%		x			
10	2	1.6%	x		x	x	x
11	2	1.6%	x		x	x	
12	2	1.6%	x	x			x
13	2	1.6%	x				x
14	2	1.6%			x		x
15	2	1.6%	x				
16	1	0.8%	x	x	x	x	
17	1	0.8%	x		x		x
18	1	0.8%	x		x		

Table 3. Frequency of prayer positions where chairs were used by the study sample.

Causes	No. of cases	Percent of Cases
Knee problems	63	50.8%
Aging	53	42.7%
Back problems	44	35.5%
Pregnancy	7	5.6%
Foot problems	6	4.8%
Disability	5	4.0%
Extra weight	4	3.2%
Other	15	12.1%

Findings of the survey also identified 2 patterns of chair placement in the row of prayer wherein either the front legs of the chair or the rear legs are aligned with the row (Figure 4). Unfortunately, both positions have disadvantages. On the one hand, when the front legs of the chair are aligned with the row, the chair may disturb the worshipers in the row behind the chair. On the other hand, when the rear legs are aligned with the row, the chair user may be misaligned with the row in some of the prayer positions such as the standing position.

Finally, based on observing people when praying, the researcher noted that when the worshiper bows, his body moves horizontally backward (approximately 18-22cm) in order to balance his body (Figure 5). Such observation has to be considered when designing the seat back of the congregational chair as explained later in this paper.

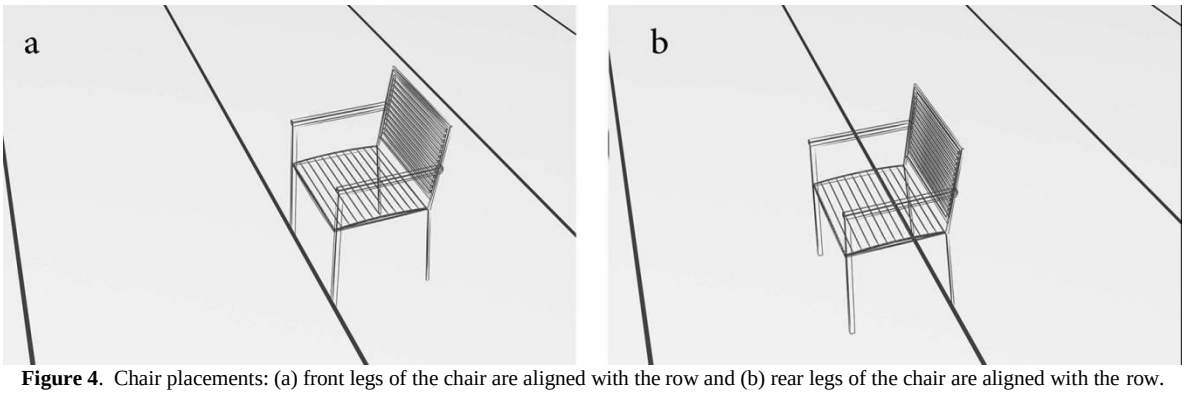

Figure 4. Chair placements: (a) front legs of the chair are aligned with the row and (b) rear legs of the chair are aligned with the row.

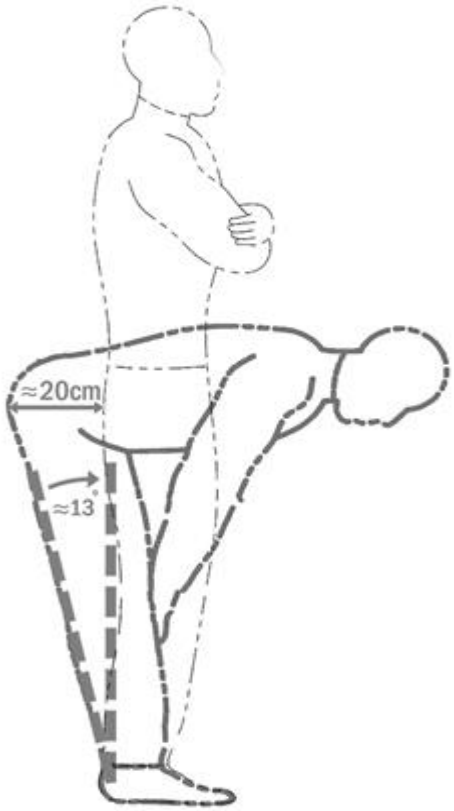

Figure 5. Approximate horizontal and angular measurement differences between standing and bowing positions.

3.2. Design Criteria for the Congregational Prayer Chair

Based on the literature review and the findings mentioned earlier, the following five basic design criteria for the novel chair of congregational prayers were established:

- It must allow the user to perform any praying position (as in Figure 1) when he/she can, without moving the chair from its place.
- It must allow the user to be aligned with the row when performing any praying positon.
- It must avoid disturbing the worshipers in the row behind.
- It must provide stable support for the body.
- It should be comfortable to sit on for a long period of time.

3.3. Prototype of the Congregational Prayer Chair

The congregational prayer chair (Figure 6) is constructed with a seat and a seat back supported between two connecting arms. The connecting arms are mounted on chair legs. Grooves and tracks are provided on the arms that permit the seat and the seat back to be moved in a predetermined manner. Accordingly, the chair would permit a worshiper to attain, when he/she can, the five prayer positions (or any selected one of them) without changing the placement of the chair legs. Thus, the chair user will not disturb the alignment of the row and not disturb the worshipers in the row behind the chair.

Figure 6. The prototype of the proposed congregational prayer chair.

The congregational prayer chair comprises a pair of U-shaped leg members that form spaced-apart front and rear legs. A pair of support bars spans the distance between and connects the front legs to the rear legs. Support bars that crisscross diagonally in X-shaped fashion connect the rear legs to each other. The support bars function to add rigidity and stability to the chair. Respective arm supports are attached to the inner surface of each respective U-shaped leg member. Each arm support is fashioned with a respective curved rear portion for reasons to be explained below. Respective straight portions extend from each curved rear portion to respective front curved portions to define the arm supports. Cushioning pads are mounted on the upper surfaces of the respective support arms. The support arms have inner surfaces that are provided with grooves or tracks therein, forming upper tracks and lower tracks. Additional track members extend angularly and rearward from the arm supports.

A seat member and a seat back are disposed between the arm supports. The seat member has front pins and rear pins attached at each side thereof. The front pins are engaged in lower curved track members for sliding movement therein. The rear pins are engaged in the back curved track for sliding movement therein. The seat back is provided with a pin extending from each side thereof for respective engagement in the upper tracks. A respective connecting arm extends between the seat back and the seat member on each side of the chair. A slot is provided along the length of each connecting arm. At its upper end, each connecting arm is interposed between the seat back and the respective curved portions of the support arms and is mounted for pivotal movement on pins. At its lower end, each of the respective connecting arms is interposed between the seat member and the curved portion of the support arms. Each rear seat pin is mounted for sliding movement in each corresponding slot.

As shown in Figure 7, the seat member and the seat back can assume one of two positions, a forward position (shown in phantom lines) and a rearward position (shown in solid lines). The rearward position is the default position due to a loaded internal-tube tension spring. The forward position can be achieved by pushing down the seat pan until it is locked by a conventional locking mechanism. In such position, the mentioned above tension spring will be further loaded. The locking mechanism consists of spring loaded pins extending from the lower portion of the two arm supports for respective engagement in the seat pan. Handles interact with the locking mechanism to release the seat and seat back for movement to the default position, when desired. In the forward position, the chair functions as a conventional chair and may be employed in this position by worshipers whose age and/or disabilities require the use of a conventional chair. In the rearward position, the seat and the seat back are moved rearward, and the seat swings down to provide open space (approximately 60-70 cm) between the arm supports. The rearward position allows the worshipers who are physically able to attain any of the prayer's position to do so without moving the legs of the chair, thus retaining the alignment of the rows and keeping the worshipers in the row behind the chair not disturbed (Figure 8).

Finally, it is important to mention that if the person who is performing prayer wants to change from the standing position to the sitting position, he or she needs to move forward to allow the seat pan to move to the forward position and vice versa. Such movement might be difficult or impossible to attain by some worshipers due to, for example, illness or not being able to keep their equilibrium. Using armrests during standing up and sitting down may be helpful for most, but not all, users.

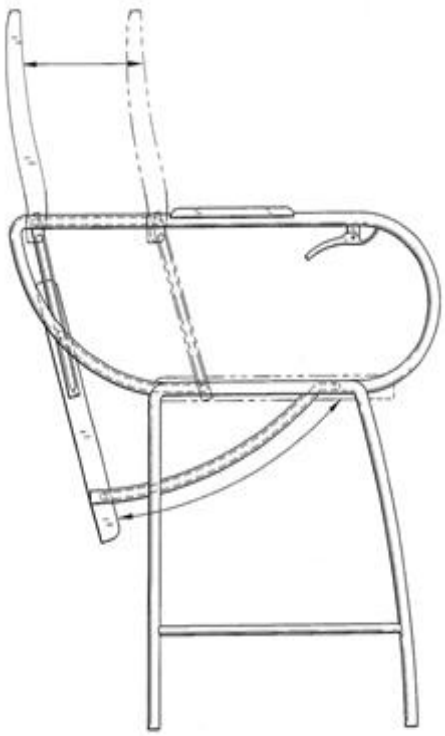

Figure 7. The forward and the rearward positions of the congregational prayer chair.

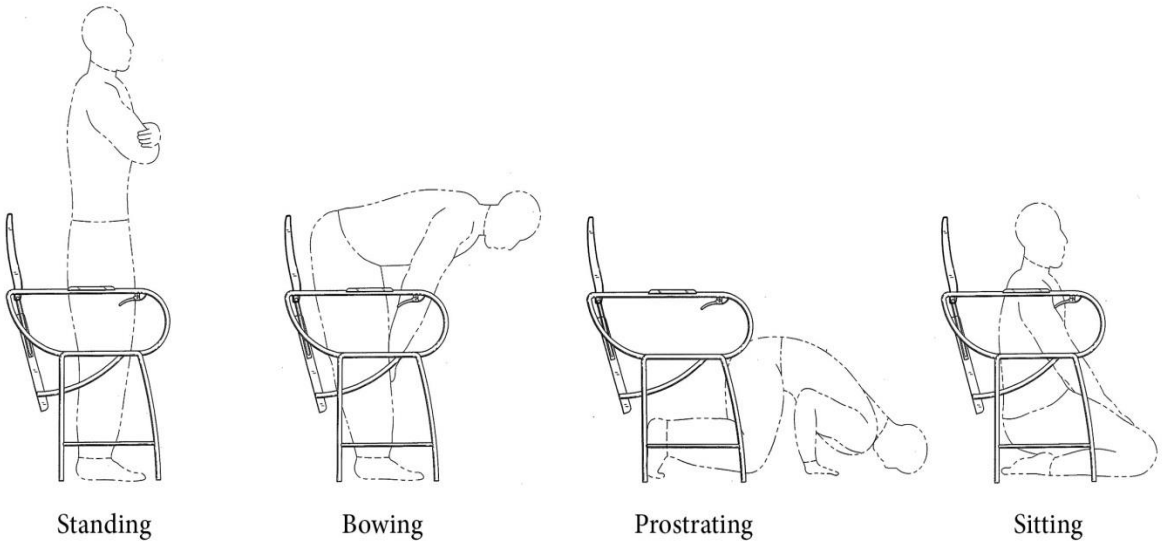

Figure 8. The rearward position of the congregational prayer chair allows worshipers to attain all or selected prayer positions whenever they can.

4. Conclusion

In the present paper, a novel conceptual design for a congregational prayer chair is addressed. Such a chair is specially designed to provide needed support for certain worshipers participating in congregational Muslim prayers. Currently, such worshipers rely on conventional chairs for assistance in attaining the prayer positions that they cannot assume. Unfortunately, using such conventional chairs cause disturbance to the worshipers in the row behind the chairs or/and cause misalignment to their users with the rows of prayer. Such problems are well known to all Muslims who pray in the mosques because they occur repeatedly in almost mosques around the world. Also, many Muslim scholars have discussed the Islamic regulations of praying with the support of chairs. They have mentioned the importance of the alignment of the chair's user with the row of prayer and, in the same time, the importance of not causing disturbance to the worshipers in the row behind the chair. However, such two conditions are impossible to be met at the same time when using conventional chairs. Therefore, the challenge of this study was to design a chair that specifically solves the aforementioned problems and in the same time considers ergonomics principles. Based on the literature review and the findings of a survey carried out in this study, five basic design criteria for the novel chair of the congregational prayer were established. Based on those criteria, a prototype of such a chair was developed. The congregational prayer chair is constructed with a seat and a seat-back supported between two connecting arms. The connecting arms are mounted on chair legs. Grooves and tracks are provided on the arms that permit the seat and the seat-back to be moved in a predetermined manner so that a worshiper can attain the required prayer positions without disturbing the alignment of the prayer rows and the other worshipers in the row behind. It is expected, God willing, that Muslim worshipers around the world would welcome this chair that is designed to alleviate the misalignment problems and still provide adequate support to attain all of the required prayer positions

5. Acknowledgement

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Note

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