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Invention and evaluation of dental blade-and-needle remover box

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Problem/Background : *A disadvantage of needle remover is that it can be used only to remove a straight needle but not a screw needle. Also, a blade remover with T-like groove was difficult to use.*

Objective : *To study about feasibility, practicability, utility and acceptability of the new blade-and-needle remover box in dental personnels.*

Design : *Descriptive study.*

Setting : *Eleven departments of dentistry in research hospitals.*

Material : *A non-disposable aluminium box was made for removing blades and needles with two containers inside for receiving the blades and needles. The box had a side-door with a top wall which had two components, a blade remover on one side and a needle remover on the other.*

Method : *Representatives from eleven hospital Departments of Dentistry were given blade-and-needle remover boxes, one box for each hospital. Questionnaires were given to the dental personnel such as the dentist, dental assistant, dental nurse or healthcare worker who had used the box for at least one week. The researcher demonstrated how to use the box by VCD and live demonstration. The representatives took responsibility to demonstrate to their colleagues both by the VCD and live demonstration. The duration of the research was from March 11, 2005 to May 12, 2005. Out of eighty-five questionnaires distributed, and seventy-seven were answered and returned, a response rate of 90.59 %. The data from the research were finally analyzed.*

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Result : *All baseline data such as gender, social position, age, occupational experience, frequency of blade removal and needle removal also were not statistically significantly different to intervention data such as understanding how to use the box, understanding from, capable of use, size and design of the box, problem of container, guideline for blade remover and needle remover and also their willingness to use the box. The only exception which showed that there was a statistically significant difference between the users who used the blade remover more than 10 times/week and those who were willing to use the box (p-value = .016) as following data; It was also founded that all of them always or usually used the box (100 %).*

Conclusion : *This study obviously showed that everyone who answered the questionnaire concluded that the blade-and-needle remover box is useful in their practice to reduce the risk or hazard from removing blades and needles. Although it has some disadvantages, the users were still satisfied and were trying to use it in their daily work.*

Keywords : *Blade remover, Needle remover, Blade-and-needle remover box.*

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วรรณี อันวีระวัฒนา. การประดิษฐ์และการประเมินผลการใช้งานของกล่องปลดมีดผ่าตัดและปลดเข็มฉีดยาทางทันตกรรม. จุฬาลงกรณ์เวชสาร 2548 ก.ย; 49(9): 527 – 41

เหตุผลการวิจัย : *เนื่องจากกล่องปลดเข็มฉีดยาที่ใช้อยู่มีข้อเสียคือปลดได้เฉพาะเข็มเสียบตรงแต่ไม่สามารถปลดเข็มหมุนเกลียว และกล่องปลดมีดผ่าตัดออกแบบคล้ายร่องตัว T ใช้งานยาก*

วัตถุประสงค์ : *เพื่อศึกษาความเป็นไปได้ในทางปฏิบัติ ความสะดวกในการใช้งานตลอดจนการยอมรับกล่องปลดมีดผ่าตัดและปลดเข็มฉีดยาแบบใหม่*

รูปแบบการวิจัย : *การศึกษาเชิงพรรณนา*

สถานที่ทำการศึกษา : *ฝ่ายทันตกรรมของโรงพยาบาลที่เข้าร่วมในโครงการวิจัย*

ตัวอย่าง *กล่องปลดมีดผ่าตัดและเข็มฉีดยาที่ประดิษฐ์ขึ้นจากโลหะอลูมิเนียม โดยมีภาชนะ 2 อันรองรับมีดผ่าตัดและเข็มฉีดยาอยู่ภายในกล่อง กล่องมีฝาปิด-เปิดอยู่ด้านหนึ่ง ส่วนบนของกล่องประกอบด้วยอุปกรณ์ 2 ส่วน คือ อุปกรณ์ส่วนปลดมีดผ่าตัดด้านหนึ่งและอุปกรณ์ส่วนปลดเข็มฉีดยาอีกด้านหนึ่ง*

วิธีการ : *คือ สุ่มตัวอย่างแจกกล่องให้กับตัวแทนจากหน่วยงาน ทันตกรรม 11 แห่ง โดยมีหลักเกณฑ์การเลือกผู้ใช้กล่องและตอบแบบสอบถามต้องเป็นบุคลากรทางทันตกรรมเช่น เป็นทันตแพทย์, ผู้ช่วยทันตแพทย์, ผู้ช่วยพยาบาล,คนงาน และต้องใช้งานกล่องอย่างน้อย 1 สัปดาห์จึงตอบแบบสอบถาม ผู้วิจัยได้สาธิตวิธีการใช้กล่องโดยใช้สื่อวีดิทัศน์และการสาธิตโดยตรงแก่ตัวแทนจากหน่วยงานต่าง ๆ และให้ตัวแทนขยายผลวิธีการใช้งานกล่องต่อเพื่อนร่วมงานต่อไป ทั้งจากสื่อวีดิทัศน์และตัวแทนสาธิตโดยตรง ระยะเวลาการวิจัย 2 เดือน ตั้งแต่ 11 มี.ค.48-12พ.ค.48 ผู้วิจัยได้แนบแบบสอบถามจำนวน 85 ชุด และได้รับการตอบกลับ จำนวน 77 ชุด คิดเป็นการตอบกลับ 90.59 %*

ผลการวิจัย : *ข้อมูลพื้นฐาน เช่น เพศ ตำแหน่ง อายุ ประสบการณ์ในอาชีพ ความถี่ในการปลดมีดผ่าตัด ตลอดจนความถี่ในการปลดเข็มฉีดยา จะไม่แตกต่างกันอย่างมีนัยสำคัญกับข้อมูลเกี่ยวกับสิ่งประดิษฐ์ เช่นความเข้าใจในการใช้กล่องปลดมีดผ่าตัดและปลดเข็มฉีดยา ความเข้าใจจากทางใด ระดับความสามารถในการใช้กล่อง ขนาดและรูปร่างของกล่อง การออกแบบกล่อง ปัญหาภาชนะที่รองรับมีดผ่าตัดและเข็มฉีดยาที่ใช้แล้ว หลักการของการปลดมีดผ่าตัด หลักการของการปลดเข็มฉีดยา และความเต็มใจที่จะใช้กล่องเป็นต้น ยกเว้นข้อมูลที่มีความแตกต่างอย่างมีนัยสำคัญ ระหว่างผู้ใช้กล่องปลดมีดผ่าตัด มากกว่า 10 ครั้งต่อสัปดาห์ กับ ผู้เต็มใจใช้กล่อง ค่า p-value = .016 และพบว่าผู้ใช้กล่องปลดมีดผ่าตัด มากกว่า 10 ครั้ง/สัปดาห์ จะเต็มใจใช้กล่องบ่อยเป็นประจำถึง 100 %*

สรุป : *จากการวิจัยศึกษาข้อมูลชี้ชัดว่าผู้ตอบแบบสอบถามทุกคนสรุปว่ากล่องปลดมีดผ่าตัดและปลดเข็มฉีดยา มีประโยชน์ต่อการทำงานเพื่อช่วยลดความเสี่ยงจากอันตรายระหว่างปลดมีดผ่าตัดและเข็มฉีดยา แม้ว่าจะมีข้อเสียเปรียบในบางประการ ผู้ใช้กล่องยังคงพึงพอใจ และพยายามใช้งานกล่องในการทำงานประจำวัน*

คำสำคัญ : *เครื่องมือปลดมีดผ่าตัด, เครื่องมือปลดเข็มฉีดยา, กล่องปลดมีดผ่าตัดและปลดเข็มฉีดยา*

The original technique used to remove a used blade or needle was either removing it manually or by a device such as forceps or needle holders. This often causes a needle-stick injury or blade cut injury. During the removal of a used blade or a needle from a syringe, they can also be contaminated by the air and can spread more infection. Dental personnel may be directly infected by their patients who may have got a hazardous disease such as Hepatitis or HIV.[1-10] The waste product can also cause hazard to the healthcare workers. Nowadays we have invented a blade-and-needle remover box, designed as a square or a cylindrical box. A disadvantage of needle remover is that it can be used only to remove a straight needle but not a screw needle. Also, a blade remover with a T-like groove was difficult to use.

The feature and the purpose of invention

The new blade-and-needle remover box consists of a blade remover and a needle remover. The action of a blade remover depends on a light pressured-force to lift up the end of a blade before removing the locking-blade. The action of a needle remover depends on loosening the screw of the syringe before removing it out. The two disposable containers inside receive used blades and needles until they are 3/4 full and then the users need to remove them. [1]

The objective of invention was to increase the efficiency of removing blades and needles while also providing an easy way of handling. The needle remover is designed to remove a straight needle and a screw needle.

Duration of invention

The invention took eight months (from March 2004 to October 2004). The primary box was invented only for the removal of needles (some brand). The inventor tried to correct the error and improved the product to gain more standard by designing the necessary and important parts of the device such as a hinge which has a serrated end and fixed with the spring from sided-wall, as show in this invention box for removing every needle. (Figure 1-5)

Components of a blade remover are as follows:

1 = a groove available for locked-part area of the blade
2 = a shoulder or an ended of a groove to lift (raise) the blade
3 = a swing hinge for touching raised blade
4 = a big hole for used blades to fall into the container
5 = a plastic cover for users' body protection

Components of a needle remover are as follows:

6 = a parallel hole for turning the needle screw out
7 = a parallel hole for removing straight needle
8 = a parallel hole for removing screw needle
9 = a hinge with serrated end to fix a screw needle
10 = a spring which connects a hinge to its wall

The perfect details of invention

Figure 1. shows a blade remover device. In application, a blade is to be placed on the groove (1) which is available for the locking-part area of the blade. Then using light pressure on the handle of the blade, the blade will be raised at the end of the groove (2) and closing the plastic cover (5), and will be further move the hinge (3) to serve the raised blade. Pulling the handle of the blade out (Figure 2), the blade will

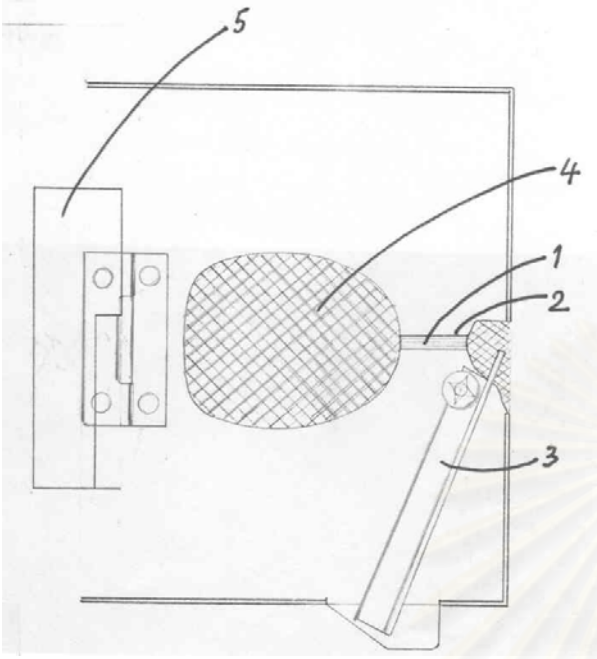

Figure 1. Shows a blade remover device.

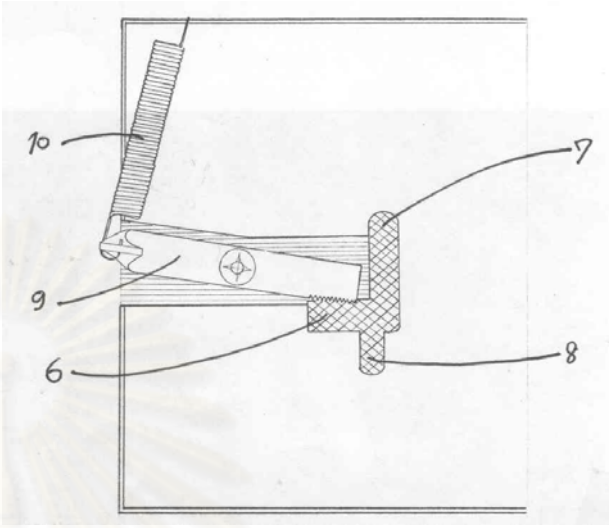

Figure 3. Shows a needle remover device.

Figure 2. Shows the moved hinge is served the raised blade and pulling the handle of the blade out.

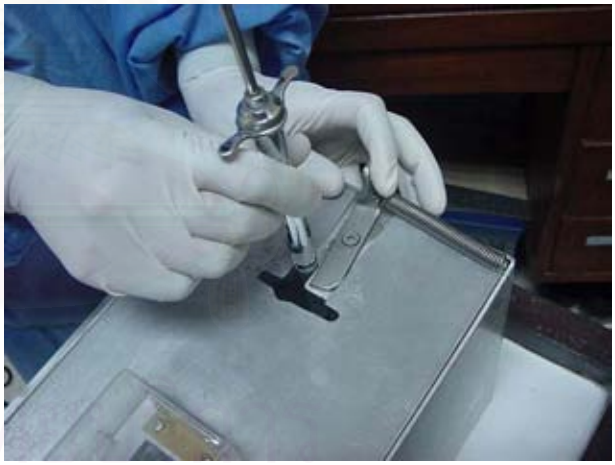

Figure 4. Shows the screw needle is fixed by a serrated end hinge which was fixed by a sided spring.

be separated from the lock and then fall through a big hole (4) into the container.

Figure 3. shows a needle remover device. In case of removing a screw needle, it is removed by a parallel hole (6). The screw needle is fixed by a serrated end hinge (9) which was fixed by a sided spring (10) (Figure 4). Turning the screw needle out from the non-disposable syringe approximately 7 rounds

Figure 5. Shows the loosened needle can be removed by a gentle force.

the needle will be loosened, and the loosened needle to another hole (8) and can be removed by a gentle force. Being removed, the needle will fall into the container. (Figure 5)

In order to remove a straight needle, it needs to be placed in the parallel hole (7) and will be removed by a gentle force, the needle will fall into the container.

Advantages of the blade-and-needle remover

1. It is designed to remove blades and both types of needle efficiently.

2. It is designed to reduce the risk of needle-stick injury and cutting-blade injury to exposed medical personnel; and to improve the management of infectious waste products for employees.

3. Being made out of aluminium, it is cheaper in the long run.

Disadvantages and corrections of blade-and-needle remover

1. Unskillful medical personnel need to learn how to use the remover. Facing new difficulties, they return to the old technique. In order to solve this problem, a conference is needed to demonstrate how to use the remover in the right way. This will encourage the personnel to use to the boxes during their daily work.

2. The problem of lacking the right inside containers to receive the used blades and needles because it is a non-disposable box. To solve this problem, a compensating container found in our environment, such as a disposable plastic cup, is used for receiving the used blades and used needles. If it is full, remove it and contain it in a bigger container then close the lid and pack it in an infectious bag.

3. The boxes are hand-made. This limits both the quality and quantity of the product. It means the procedures of production are not all accurate (medium quality) and small amount of boxes can be produced. In the beginning, it was not well distributed among medical personnel. To solve the problem, the production needs to be industrialized, a step which will be based on the results of this pilot study.

This research was a descriptive study to test the invention of a blade-and needle remover. The objective of this study is to study about feasibility, practicability, utility and acceptability of the new blade-and-needle remover box in dental personnels.

Material

A non-disposable aluminium box was made for removing blades and needles with two containers inside for receiving blades and needles. The box had a side-door of which the top wall had two components which were a blade remover on one side and a needle remover on the opposite side.

Method

Representatives from eleven departments of dentistry of sampled hospitals such as King Chulalongkorn Memorial Hospital, Oral and Maxillofacial Surgery Department Faculty of Dentistry Chulalongkorn University, Dental Institution - Ministry of Public Health, Tak-Sin Hospital, Hua-Shiew Hospital, Som-Dej Na Sriracha Hospital, Neurology Institution, Psychology Institution, Bumradnaradul Hospital, Chest Disease Institution – Ministry of Public Health, Public Health Center 6 of Bangkok Metropolitan. They were given a blade-and-needle remover, one for each institute. Questionnaires were later distributed to the dental personnel such as the dentist, dental assistant, or healthcare workers who used the box one week. The researcher demonstrated how to use the box by a VCD and live demonstrations. The representatives mostly were dental assistants and were responsible for showing their colleagues (dental assistant or healthcare worker) the VCD and conducting live demonstrations. The duration of this research was two months (from March 11, 2005 to May 12, 2005). Eighty-five questionnaires were distributed . Because it was depended on the amount of dental assistants or healthcare worker in each hospital and their willingness of using the box. Not only dental assistant but also healthcare worker were two- thirds of this target group (58 in 85). The seventy-seven questionnairs were answered, a 90.59 % response rate. The data from the research are as follows:

Result

We collected data from the questionnaires and presented in the following tables and a figure.

Table 1 shows Fisher's Exact test, at $p < 0.05$ no statistical difference of understanding how to use the remover according to gender, position, age, occupational experience, and frequencies of blade and needle removal. There was no statistical significant difference of understanding from and capable of using the box at the baseline data also. According to table 1, we suggested that understanding how to use the remover, understanding from or capable of using the remover were not depended on gender, position, age, occupational experience, frequency of blade and needle removal. That means every users understand of how to use the box, understand either from VCD or demonstration or both and capable of using the box. So the blade and needle remover is simple and easy to use.

Table 2 shows Fisher's Exact test, at $p < 0.05$ no statistically significant difference of size of the box which is designed for working and problem of container in gender position, age, occupational experience, frequencies of blade and needle removal. The percentage levels in various baseline data were approximate data such as mentioned above. This table illustrates that the users are satisfied with the box and no statistically significant difference of size of the box, design for working and problem of container in various users.

Table 3 shows Fisher's Exact test , at $p<0.05$ no statistically significant difference of guideline of blade remover (lift and separate), guideline of needle remover (screw out and remove) and willingness to use the box in various users except that was statistically significant difference in the users who are willing to use and who have frequency of blade removed. The percentage between the two groups of

Table 1. Baseline data related to questions about understanding how to use the box, understanding from and capable of using the box.

	Understanding how to use the box			Understanding from			Capable of using the box		
	Good N(%)	Fair N(%)	P - value	Both VCD and demonstration N(%)	Either VCD or demonstration N(%)	P - value	Good N(%)	Fair N(%)	P - value
Gender									
Female	56(74.7 %)	19(25.3 %)	1.000	34(45.3 %)	41(54.7 %)	1.000	48(64.0 %)	27(36.0 %)	.539
Male	2(100.0 %)	0(.0 %)		1 (50 %)	1(50 %)		2(100.0 %)	0(.0 %)	
Social position									
Not a dentist	45(77.6%)	13(22.4 %)	.541	30(51.7 %)	28(48.3 %)	.066	39(67.2 %)	19(32.8 %)	.581
A dentist	13(68.4 %)	6(31.6 %)		5(26.3 %)	14(73.7 %)		11(57.9 %)	8(42.1 %)	
Age									
< = 40 yrs	40(75.5 %)	13(24.5 %)	1.000	26(49.1 %)	27(50.9 %)	.460	35(66.0 %)	18(34.0 %)	.800
> 40 yrs	18(75.0 %)	6(25.0 %)		9(37.5 %)	15(62.5 %)		15(62.5 %)	9(37.5 %)	
Occupational experience									
< = 10 yrs	33(75.0 %)	11(25.0 %)	1.000	21(47.7 %)	23(52.3 %)	.817	28(63.6 %)	16(36.4 %)	.814
> 10 yrs	25(75.8 %)	8(24.2 %)		14(42.4 %)	19(57.6 %)		22(66.7 %)	11(33.3 %)	
Frequency of blade removal (times/week)									
< = 10	43(74.1%)	15(25.9 %)	.768	26(44.8 %)	32(55.2 %)	1.000	36(62.1 %)	22(37.9 %)	.417
> 10	15(78.9 %)	4(21.1%)		9(47.4 %)	10(52.6 %)		14(73.7 %)	5(26.3 %)	
Frequency of needle removal (times/week)									
< = 10	25(83.3 %)	5(16.7 %)	.279	11(36.7 %)	19(63.3 %)	.248	20(66.7 %)	10(33.3 %)	1.000
> 10	33(56.9%)	14(73.7%)		24(51.1 %)	23(48.9 %)		30(63.8 %)	17(36.2 %)	

From Fisher's Exact test at $p < 0.05$

Table 2. Baseline data related to questions about size of box, design for working and problem of container.

	Size of the box			Design for working			Problem of container		
	All right N (%)	Not all right N (%)	P - value	Convenient N (%)	Not convenient N (%)	P - value	Have problem N (%)	Haven't problem N (%)	P - value
Gender									
Female	65(86.7 %)	10(13.3 %)	1.000	61(81.3 %)	14(18.7 %)	1.000	29(38.7 %)	46(61.3 %)	.524
Male	2(100.0 %)	0(.0 %)		2(100.0 %)	0(.0 %)		0(.0 %)	2(100.0 %)	
Social position									
Not a dentist	52(89.7 %)	6(10.3 %)	.251	48(82.8 %)	10(17.2 %)	.737	22(37.9 %)	36(62.1 %)	1.000
A dentist	15(78.9 %)	4(21.1 %)		15(78.9 %)	4(21.1 %)		7(36.8 %)	12(63.2 %)	
Age									
< = 40 yrs	46(86.8 %)	7(13.2 %)	1.000	42(79.2 %)	11(20.8 %)	.529	23(43.4 %)	30(56.6 %)	.138
> 40 yrs	21(87.5 %)	3(12.5 %)		21(87.5 %)	3(12.5 %)		6(25.0 %)	18(75.0 %)	
Occupational experience									
<= 10 yrs	37(84.1 %)	7(15.9 %)	.502	35(79.5 %)	9(20.5 %)	.766	17(38.6 %)	27(61.4 %)	1.000
> 10 yrs	30(90.9 %)	3(9.1 %)		28(84.8 %)	5(15.2 %)		12(36.4 %)	21(63.6 %)	
Frequency of blade removal (times/week)									
<= 10	51(87.9 %)	7(12.1 %)	.701	46(79.3 %)	12(20.7 %)	.497	22(37.9 %)	36(62.1 %)	1.000
> 10	16(84.2 %)	3(15.8 %)		17(89.5 %)	2(10.5 %)		7(36.8 %)	12(63.2 %)	
Frequency of needle removal (times/week)									
< = 10	24(80.0 %)	6(20.0 %)	.175	24(80.0 %)	6(20.0 %)	.769	13(43.3 %)	17(56.7 %)	.474
> 10	43(91.5 %)	4(8.5 %)		39(83.0 %)	8(17.0 %)		16(34.0 %)	31(66.0 %)	

From Fisher's Exact test at $p < 0.05$

Table 3. Baseline data related to questions about guideline of blade remover, guideline of needle remover and willingness to use the box.

	Guideline of blade remover		P - value	Guideline of needle remover		P - value	Willingness to use the box		P - value
	Lift and Separate			Screw out and remove					
	Yes N (%)	No N (%)		Yes N (%)	No N (%)		Always, usually use N (%)	Sometimes use N (%)	
Gender									
Female	74(98.7 %)	1(1.3 %)	1.000	66(88.0 %)	9(12.0 %)	1.000	60(80.0 %)	15(20.0 %)	1.000
Male	2(100.0 %)	0(.0 %)		2(100.0 %)	0(.0 %)		2(100.0 %)	0(.0 %)	
Social position									
Not a dentist	57(98.3 %)	1(1.7 %)	1.000	51(87.9 %)	7(12.1 %)	1.000	46(79.3 %)	12(20.7 %)	.750
A dentist	19(100.0 %)	0(.0 %)		17(89.5 %)	2(10.5 %)		16(84.2 %)	3(15.8 %)	
Age									
< = 40 yrs	52(98.1 %)	1(1.9 %)	1.000	46(86.8 %)	7(13.2 %)	.712	42(79.2 %)	11(20.8 %)	.765
> 40 yrs	24(100.0 %)	0(.0 %)		22(91.7 %)	2(8.3 %)		20(83.3 %)	4(16.7 %)	
Occupational experience									
< = 10 yrs	43(97.7 %)	1(2.3 %)	1.000	40(90.9 %)	4(9.1 %)	.486	36(81.8 %)	8(18.2 %)	.777
> 10 yrs	33(100.0 %)	0(.0 %)		28(84.8 %)	5(15.2 %)		26(78.8 %)	7(21.2 %)	
Frequency of blade removal (times/week)									
< = 10	58(100.0 %)	0(.0 %)	.247	49(84.5 %)	9(15.5 %)	.102	43(74.1 %)	15(25.9 %)	.016
> 10	18(94.7 %)	1(5.3 %)		19(100.0 %)	0(.0 %)		19(100.0 %)	0(.0 %)	
Frequency of needle removal (times/week)									
< = 10	30(100.0 %)	0(.0 %)	1.000	24(80.0 %)	6(20.0 %)	.142	22(73.3 %)	8(26.7 %)	.245
> 10	46(97.9 %)	1(2.1 %)		44(93.6 %)	3(6.4 %)		40(85.1 %)	7(14.9 %)	

From Fisher's Exact test at $p < 0.05$

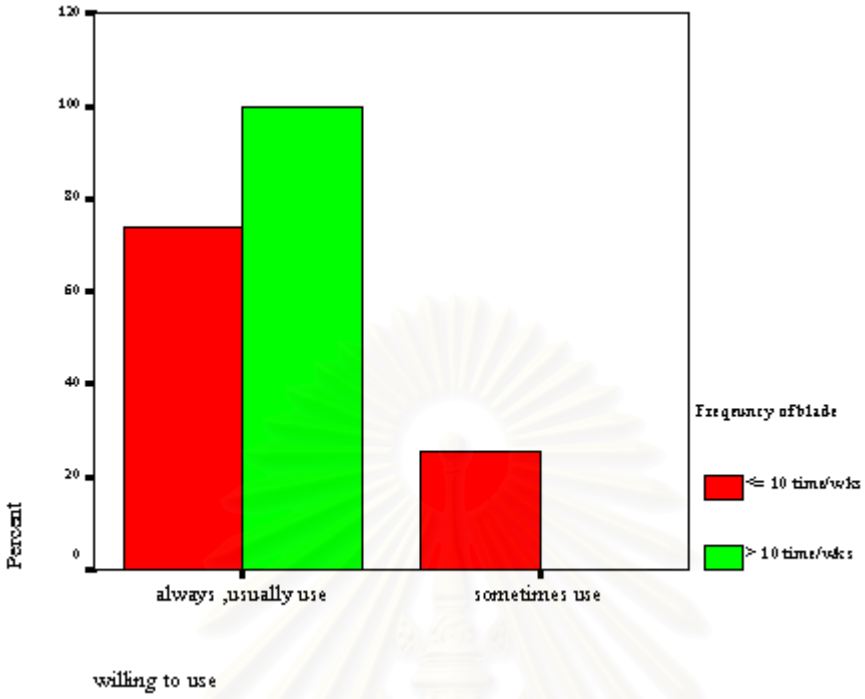

Figure 6. Shows the users who used the blade removal more than 10 times/week and were always willing to use it.

users who have frequency of blade removal less than and equal 10 times/week and more than 10 times/ week were 74.1 % and 100.0 %, respectively. That is quite a wide range. As well as it was clear that every users who have frequency of blade removed more than 10 times/week always or usually willing to use the remover. It was obviously showed in bar-chart. (Figure 6)

Although table 1. 2 and 3 show no statistical difference of invention data (the questions from the questionnaires) and various baseline data except only one relation which was statistically difference of the user who are willing to use the box and who have frequency of blade removal (p-value = .016). From all tables we also illustrated that most of the users understand how to use the box and are capable of using it. They are satisfied with the size and the design of the box including understanding the guideline of both the blade remover and the needle remover. Lastly, they always plan to use it. Everyone who answered the questionnaire concluded that the blade and needle remover box is useful in practice to reduce risk or hazard from removing the blades and needles.

Discussion

Centers for Disease Control and Prevention (CDC) defined the term universal precautions as a set of precaution designed to prevent transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and other blood borne pathogens in health care settings.[1] Under universal precautions, blood and saliva (in dentistry) of all patients are considered potentially infectious for HIV, HBV, and other blood borne pathogens.Applied universal precautions means that the same infection control procedures for any given dental procedure must be used for all patients.

The infection control guidelines include appropriate procedures to protect dental patients as well as all dental healthcare workers whether employees or employers from occupational transmission of infectious diseases in dental office.[1-2] Percutaneous injuries should be prevention of these incidents by assessing safer devices and work practices. After a needle-stick exposure to an infected patient, a healthcare worker's risk of infection depends on the pathogen involve immune status of the worker, the severity of the needle-stick injury, and the availability and use of appropriate post-exposure. [3] In 1995 Shapiro CN [4] reported that about one-third to one-half of persons with acute HBV infection develop symptoms of hepatitis such as jaundice, fever, abdominal pain. Most acute infections resolve, but 5 % to 10 % of patients develop chronic infection with HBV that carries 20 % lifetime risk of dying from cirrhosis and 6 % risk of dying from liver cancer. In 1998 CDC [5] reported that HCV infection often occurs with no symptoms or only mild symptoms. But unlike HBV, chronic infection develops in 75 % patients, with active liver disease developing in 70 %. Of the patients with active liver disease, 10 % to 20 % develop cirrhosis, 5 % develop liver cancer. In 1994 Gerberding[6] and in 1999 Ippolito et al.[7] reported that data were combined from more than 20 worldwide prospective studies of healthcare worker exposed to HIV-infected blood through a percutaneous injury to estimate the rate of HIV transmission. In all, 21 infections followed 6,498 exposures for an average rate of 0.3 % per injury. Earlier studies [8-14] showed that approximately 38 % injuries occurred during the use, and 42 % after the use and before disposal.

In 1991, McCormick et al, [15] Yassi and McGill [16] showed that earlier studies of needle-stick injuries 10 % to 25 % occurred when recapping a used needle.

Needle-stick injuries and sharp instrument injuries are an important and continuing cause of exposure to serious and fatal diseases among healthcare workers. [5,17] Greater collaborative efforts by all stakeholders are needed to prevent needle-stick injuries and the tragic consequences. Such efforts are best accomplished through a comprehensive program that addresses institutional, behavioral, and development that contribute to the occurrence of needle-stick injuries in healthcare workers.

From this research study, some users suggested that the blade-and-needle remover box was not practical because of the blade remover device was on the opposite side of a top wall. It should be designed on a side-door of a top wall for the boxes were not removed. According to this design, the users are capable for removing both blade and needle at only one position. This suggestion was a good idea for the researcher to correct the later boxes to gain more practical. The other suggestion was the movable box which it should be fixed by screw or locking – part to increase stability of the box. The lastly suggestions were problem of lacking of containers and problem of limitation of infection control of some component part. It couldn't be sterilized in an autoclave, but it was cleaned by cold sterilization. The researcher gathered these suggestions to correct product improvements to gain more standard and more practical.

The author would like to suggest the blade-and-needle remover box to avoid sharp instrument injuries. This protection helps save healthcare workers and saves a lot of costs for post-exposure treatment. It is time for healthcare workers to practice carefully and to use devices during daily work to reduce risks of sharp instrument injuries.

Conclusion

This study obviously showed that everyone who answered the questionnaire concluded that the blade-and-needle remover box is useful in their practice to reduce the risk or hazard from removing blades and needles. Although it has some disadvantages, i.e. the lack of containers and non-accuracy of hand–made product, but most of the users were still satisfied with them and would be willing to use the boxes for their safety.

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