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Efficacy of "Safe Sea lotion" in preventing *Chrysaora* jellyfish stings in normal volunteers

Purpose:

The purpose of this study was to test the protection levels of a jellyfish (coelenterate) sting inhibitor ("repellent"), called Safe Sea lotion, against the *Chrysaora* (sea nettle) jellyfish.

Envenomation by cnidarians is a worldwide problem. Cnidarians are equipped with stinging cells, each of which contains a stinging apparatus capable of delivering toxins into the victim when activated. The product tested inhibits the stinging mechanism based on patented technology.

The lotion has been successfully tested on a dangerous species (Rhopilema nomdica) in the eastern Mediterranean, but no trials have taken place in the United States to date. The *Chrysaora* (sea nettle) species were used for testing purposes in this experiment because of their prevalence in the waters of the United States, primarily in the Chesapeake Bay and along the coastline of Florida, and because they generally produce, pain, redness and swelling at the site of the reaction, but are not considered to be dangerous to humans.

Protocol:

Twelve subjects were enrolled in the study as normal volunteers. Each signed an informed consent, met inclusion and exclusion criteria and underwent a physical exam before enrollment in the study. Subjects were randomized in a double-blind fashion to receive application of either Safe Sea lotion or placebo (Coppertone) sunscreen to the left forearm with the other lotion to be applied on the right. An area of 18 x 6 cm was marked on each forearm and Safe Sea lotion and placebo sunscreen were applied to the forearms according to the randomization protocol. After the sunscreen was allowed to dry for 10 minutes, two marks were made in the center of the application area at a distance of 5 cm.

Tentacles were then removed with tweezers and held vertically in the air to allow excess water to drip off. The tentacles were placed on the skin with the lower end of the tentacles applies to the distal mark and 5 cm of tentacle placed in a straight line on the forearm until it reached the proximal mark. The tentacle was left in contact with the forearm for 30 seconds at which time it was removed with tweezers. The same protocol was repeated on the right arm. If the subject experienced no discomfort during the 30 seconds of application, the tentacles were applied to each arm for a total of 15 additional seconds. If the subject noted no discomfort, the tentacles were placed in contact with the forearms for an additional15 seconds.

Subjects were asked to note any discomfort and medical evaluation took place at 0, 15, 30, 60, 90, and 120 minutes after completion of tentacle application. Pain was scored on a 0 (no pain): 1 (pain) scale, though subjects who felt discomfort in both arms were given a score of 0.5 if one of the arms experienced significantly less discomfort than the other. Additionally, the degree of inflammation was evaluated by a dermatologist according to the following criteria: 0 (no change), 1 (skin color change only), 2 (edema), 3

(blister or ulcer formation). These measurements were taken at the same time points. Additionally, digital and 35 mm photographs were taken of each arm at 0 and 20 minutes.

Blood pressure measurements were taken at 0 and 15 minutes to assure patient safety and ACLS trained staff was present throughout the experiment in case of adverse reaction.

Results:

Pain:

All twelve enrolled subjects completed the protocol. The mean application time of tentacles was 37.5 seconds with a minimum time of 30 seconds and a maximum of 60 seconds (see Table 1). Of the twelve enrolled subjects, only two noted any discomfort in the arm treated with Safe Sea lotion and in both cases this discomfort was rated as significantly less than in the placebo treated arm. The mean and median times before maximum pain was felt were 1.25 minutes and 0 minutes respectively. The mean and median measures of discomfort were 0.04 and 0 respectively.

In contrast, all twelve subjects noted discomfort in the arm treated with placebo. The majority of subjects noted maximum discomfort not at the time of application, but 15 minutes after application with a mean time of 22.5 minutes and a median of 15 minutes. The mean and median measures of discomfort with both 1.0 in this group as all subjects noted discomfort in this arm. The p-values were <0.01for comparison of discomfort in Safe Sea treated and placebo treated arms.

Skin Reaction:

On medical examination performed by a blinded physician and scored as above, there was no evidence of reaction in any of the arms treated with Safe Sea lotion. The arms treated with placebo did demonstrate visible and/or palpable evidence of sting in every case with mean and median scores of 1.42 and 1.0 respectively. The time required to reach maximum skin changes was noted to be longer than the maximum time required to reach maximum discomfort with mean and median times of 36.25 minutes and 30 minutes respectively. Again p-values were <0.01 demonstrating a statistically significant difference between the two groups.

Table 1:

	Safe Sea					Placebo			
Subj #	Max Tx	Max Pain		Max Rct		Max Pain		Max Rct	
	Time (sec)	Amount	Time (min)	Amount	Time (min)	Amount	Time (min)	Amount	Time (min)
1	45	0	0	0	0	1	15	2	15
2	30	0	0	0	0	1	60	1	30
3	30	0	0	0	0	1	30	2	30
4	30	0	0	0	0	1	15	1	30
5	30	0	0	0	0	1	15	1	30
6	30	0	0	0	0	1	30	2	30
7	45	0	0	0	0	1	30	2	30
8	45	0	0	0	0	1	15	1	120
9	60	0	0	0	0	1	30	1	30
10	45	0.5	0	0	0	1	0	2	30
11	45	0	15	0	0	1	15	1	30
12	30	0	0	0	0	1	15	1	30
median	37.50	0.00	0.00	0.00	0.00	1.00	15.00	1.00	30.00
mean	38.75	0.04	1.25	0.00	0.00	1.00	22.50	1.42	36.25
p value						0.00	0.00	0.00	0.00

Conclusion:
Safe Sea lotion inhibited the sting of *Chrysaora* jellyfish in ten of twelve subjects and diminished the sting of the jellyfish in the other two subjects. No visible signs of sting were notable in any of the arms treated with Safe Sea lotion, but were present in all twelve of the arms treated with placebo. Safe Sea lotion significantly inhibits the development of pain and skin reaction resulting from contact with sea nettle tentacles