

A COMPARISON OF PULSE OXIMETRY VALUES IN OXYGEN DEPENDENT PATIENT(S), WITH SATISFACTION RATINGS OF DUAL PRONG VS SINGLE PRONG ADULT LOW FLOW NASAL CANNULA(S)

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BACKGROUND: The current state of oxygen delivery systems is based on a dual-prong cannula design that was introduced in 1949. Dual nasal cannulas are used to deliver supplemental low flow oxygen to people in need of respiratory support. A study was conducted to determine patient inputs on the dual prong devices and if a patient population found the current dual prong technology acceptable and if a new technology were introduced into that population, what features would be of importance to convert to new technology usage.

METHODS: In 121 patients currently on oxygen therapy, we looked at certain patient demographics, age, sex, flow rates, time usage of cannula, oxygen source—from continuous and or pulse dose flow devices and years of therapy. The population was asked a series of questions about their dual prong cannulas. The patients were then asked in a blinded fashion, if they would be interested in certain design features that may have a benefit to them. Following this, a new device was provided to the patients and additional information was gathered.

STATISTICAL ANALYSIS: A third party statistician was used to determine statistical methods and to perform the analysis. The results were separated into two groups according to device system and POX reading. In each group means and standard deviations (SD) were calculated. Comparable groups were tested against each other using non-independent *t*-tests. Probability values less than 0.05 were considered to be significant. The sub-population contained 70 patients with an average age of 70 and consisted of 20 female and 50 males. The patients were in a relaxed position and had stable respiratory rate for both POX reading. Paired *t*-test as the Hypothesis Test using the following formula:

$$t = \frac{\sum d}{\sqrt{n(\sum d^2) - (\sum d)^2}}$$

SATISFACTION RATING: The population had an age range of 46-99, with an average age of 71.5 years. The population was 44% female and 56% male. 77% had a flow rate between 1-3 LPM and 23% had a flow rate between 4-6 LPM.

DIS-SATISFACTION RATING OF DUAL PRONG CANNULA

Rank Order of Dual Prong Cannula Issues	Number of issues in the Population	Percentage (%) of patients with issues
1) Do prongs ever become displaced from nostril?	81	67 %
2) Need to remove cannula to eat or drink?	51	42%
3) Self-consciousness wearing cannula, especially in public?	44	36%
4) Constriction around neck by tubing?	42	35%
5) Sore / irritated nostrils interior?	38	31%
6) Irritation / sore around ears from tubing contact?	37	31%
7) Need to use protective pads to reduce skin irritation around the ears?	30	25%
8) Sore / irritation upper lip?	11	9%

WITHIN THE 90% POPULATION THAT HAD ISSUES, 79% HAD MULTIPLE ISSUES (MORE THAN ONE) WITH THE DUAL PRONG CANNULA. ONLY 10% RARELY HAD ISSUES WITH THE DUAL PRONG DEVICE.

SATISFACTION RATING OF SINGLE PRONG CANNULA

The clinical monitor then provided a newly designed device and fit the device on the patients, connected it to an oxygen source, which the patient used in a clinical setting for five to fifteen minutes. Following the clinical use of the new design, the patients were asked the following questions, the scaled response was based on a "Yes or No."

Questions about a newly designed single cannula device to determine patient interest and possible conversion to a new design.	Number of patients that responded, "No"	Number of patients that responded, "Yes"
Is the Single Cannula more comfortable?	0%	98%
Does the Single Cannula feel stable and secure?	1%	99%
Would you be interested in using the Single Cannula when it became available?	2%	98%

STATISTICAL RESULTS AND CONCLUSIONS:

Mean difference in POX measures = -0.73
 95% confidence Interval -0.50 to -0.95
 t-statistic = -7.65
 Degree of freedom: df=69
 1 tailed p-value p < 0.00001

Hence we reject the Null Hypothesis and accept the Alternate Hypothesis. Of the two data sets (Dual vs Single), the analysis shows a high statistical significance that the Single Cannula delivers more oxygen in the 70 patients.

INTERPRETATION: The study has demonstrated that the dual prong design has many features that are highly dissatisfying (Frequent and or Constant issues) within the patient population. When introduced to a new human factors approach to oxygen delivery systems the patients were very interested in converting to a more comfortable, stable / secure, less invasive, less visible—ergonomic single cannula design. We found that the single cannula devices provided higher statistically significant POX readings when compared to dual prong POX readings across flow rate categories within a defined patient population and across both continuous and pulse delivery type devices.