Pass Rates of IROC Houston's Head and Neck Phantom Based On Technique, Manufacturer, and Treatment Planning System

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Purpose:

To describe and report the passing rates of previous IROC head and neck phantom irradiations based on treatment technique, machine manufacturer, and treatment planning system.

Methods:

IROC Houston's anthropomorphic head and neck phantom is used for multi-institutional clinical trial IMRT credentialing and quality assurance purposes. It has two PTVs that house TLD and radiochromic film. Passing criteria for the HN phantom requires that an institution be within ± 7% of TLD dose and ≥ 85% pixels pass for gamma with a 4 mm distance to agreement. Pass rates were analyzed and compared. The Pearson Chi-Square Test was used to calculate the significance of pass rates using treatment technique, machine manufacturer and treatment planning system.

Figure 1: Image of IROC Houston's solid Head and Neck Phantom with the insert and TLD block.

Results:

2614 irradiation have a total pass rate of 87%. Rapid Arc (n = 482), VMAT (n = 422), Dynamic MLC (n = 591), and Segmental MLC (n = 908) were the top 4 treatment techniques.

Their success rates were 95%, 93%, 91%, and 77%, respectively. Of current popular machine types, CyberKnife (n = 22), ,Elekta (n = 420), TomoTherapy (n = 173), and Varian (n = 1765) had pass rates of 100%, 80%, 95%, and 90%, respectively. The most popular treatment planning systems used were Multiplan (n = 22), TomoTherapy (n = 173), Eclipse (n = 1237), Raystation (n = 77), and Pinnacle (n = 722).

Table 1 shows pass rates for machine types used. There was no statistically significant difference between the group (p = 0.386). Table 2 shows pass rates between treatment planning systems. There was no significance between this group either (p = 0.387).

Pass Rate for Manufacturerer Used			
Manufacturerer	Total	Total Pass	Pass/Fail Rate (%)
Accuray	22	22	100%
Elekta	420	334	80%
Novalis	48	42	88%
Siemens	180	125	69%
TomoTherapy	173	165	95%
Varian	1765	1591	90%
Mitsubishi	1	1	100%
Viewray	5	5	100%

Table 1: A list of the manufacturers used to irradiate IROC's head and neck phantom along with their respective pass rates. Even though some manufacturers such as Mitsubishi and Viewray boasted an impressive 100% pass rate, their small sample size has to be taken into account.

Results (Cont'd):

Table 3 shows there was a statistically significant difference (p = 0.028) for the treatment technique used.

Pass Rate for Treament Planning System Used			
TPS	Total	Total Pass	Pass/Fail Rate (%)
CMS Monaco	87	79	91%
Eclipse	1237	1144	92%
Multiplan	22	22	100%
Pinnacle	722	587	81%
Raystation	77	65	84%
TomoTherapy	167	159	95%
XiO	173	124	72%

Table 2: Represents pass rates for most relevant treatment planning systems.

Pass Rate for Technique			
Technique	Total Pass	Total	Pass/Fail Rate (%)
Rapid Arc	458	482	95%
VMAT	550	591	93%
Dynamic MLC	573	591	91%
Segmental MLC	863	908	77%

Table 3: Pass rates for top 4 treatment techniques.

Conclusion:

Based on the collective data, we will investigate further whether the treatment technique really affects the pass rate of each HN phantom irradiation and that the results are not due to chance.

Support:

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