

## **Comparison of KY-jelly and ultrasound transmission gel as coupling medium for ultrasound imaging**

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**ABSTRACT:** Ultrasound Imaging is a medical procedure used in diagnostics. The said procedure required an ultrasound coupling gel as a medium in transmitting ultrasound waves to form an image. This study compared the images produced using KY-Jelly and the standard ultrasound coupling gel as a medium to transfer sound waves from the transducer head into the patient skin to generate a high quality and detailed ultrasound image. Images were compared and assessed using spatial resolution, contrast resolution, and artifacts as parameters. Results show that KY-Jelly used as coupling medium in ultrasonography produced a better image than of the standard ultrasound coupling gel and it can be considered as an alternative to the standard ultrasound coupling gel.

**Keywords:** KY-Jelly, ultrasound, commercial ultrasound coupling gel

### **INTRODUCTION**

Ultrasound imaging or ultrasound sonography is a non-invasive process that uses high frequency sound waves to generate images of the internal organs, for detection of mass and other pathological anomalies. It is also useful in measurements of organs and localization of foreign bodies. Ultrasonography has now become the main screening modality in subjected disease of the parenchymal organs of the abdomen. It is the modality of choice for the evaluation of disease of the gallbladder, biliary tract, pancreas, the abdominal aorta. It is also used in almost every systems of the body (Bhargava, 2004).

Ultrasound waves are generated by probes containing material exhibiting the piezoelectric effect (Hatfield & Bodenhan, 1999). Piezoelectric crystal is the heart of an ultrasound unit or

probe (Bhargava, 2004). The active part of the probe involves two crystals. One transmits the ultrasound waves and the other receives those (Parks, 2005). Sound in MHz range used in medical ultrasound is not significantly transmitted by air or bone, in contrary fluids which make up the larger part of soft tissues in the body transmits the sound waves very well. Reflection, refraction, scatter absorption and transmission of sound occurs as it passes through the soft tissues in structures allowing characterization of the shape and internal architecture of the structure or organ (Hatfield & Bodenhan, 1999).

An essential aspect of any ultrasound examination is the application of a conduction agent between the transducer and the skin surface. The conduction agent permits effective transmission of ultrasound into tissues, reduces artifact caused by reflected ultrasound waves, and provides lubrication between the patient and the transducer (Windish et al., 2010). Ultrasonic media should be completely free of air bubbles in order to ensure the perfect sound transmission. Liquids like water and alcohols basically are suitable media however with regards to their volatility and low viscosity that does not perform well in imaging procedures. That is why specific gels have been developed (Lautenschlager, 2008).

The ultrasound coupling gel has no scent or color, it is non-staining and non-irritating, It is acoustically accurate for the broad range of frequencies used, it is water soluble, and it does not contain formaldehyde and spermicide. Ultrasound gel is highly conductive, it is clear and free from bubbles and air, smooth and can consistently spread easily without running or drying prematurely. Commercial ultrasound coupling gel usually comprises at least 90% of water, at least one preservative, and at least one base substance, wherein the composition can withstand pressure up to 30 kp, without tearing (Dietrich & Kreusch, 2007). The problem encountered in using the commercial ultrasound coupling gel in ultrasonography is its limited availability. KY-Jelly was patented in 1904 as a surgical lubricant. It was produced by Johnson & Johnson, and introduced in 1919 for personal use as lubricant. It is hygienic than oil-based lubricant and ultrasound gels. KY-Jelly has high viscosity, it minimizes bubble formation and it is water soluble(Thomas, 2007). It contains at least one base product and at least one preservative esimilar to the commercial ultrasound coupling gel. KY-Jelly is available in any drugstores than commercial ultrasound coupling gel. However, the use of KY-Jelly as ultrasound coupling gel has not yet been established. As such, this study aims to compare the image quality

produced by KY-Jelly in terms of spatial resolution, temporal resolution, image artefacts and shadowing. The significance of this study is to prove that KY-Jelly can be used as a substitute coupling medium in producing good quality image in ultrasonography because it is highly available in any drugstores.

## **MATERIALS AND METHODS**

### **Testing Location**

The experiment was performed at Batangas Medical Center (BMC), Batangas City under the provision of an ultrasound technician using Samsung Medison Sonoace X4 and X6 ultrasound machine.

### **Participants**

Twenty (20) male volunteers between twenty to thirty (20-30) years old were asked to participate in this study. The inclusion criteria for participants are male sex with normal body habitus. The exclusion criteria are hypersthenic patients, females of child bearing potential, minors, indigent and those who have cognitive and psychiatric disorders. All protocol involving human participants were reviewed and approved by the Institutional Ethics Review Board of Lyceum of tge Philippines University.

### **Ultrasound Procedure**

The following materials were used during the examination; Samsung Medison Sonoace X4 and X6 ultrasound machine, curved array transducer or convex probe, Aquasonic coupling gel, Jhonson and Johnson Durex KY-Jelly, and Trust condom to protect the transducer. In preparing the ultrasound machine, the console was powered on to start up the machine. The ultrasound display was set to B-Mode. Curved array transducer or convex probe was used to have a clear image of the right kidney. There is no special preparation required for the patient prior to the schedule of the ultrasound procedure. Before the procedure, the patient was asked to wear a hospital gown for his comfortability and the ultrasonographers convenience. The patient was asked to be in prone or decubitus position. 5 ml of the standard ultrasound coupling gel was applied to the area of interest. The ultrasound procedure was repeated but using KY-Jelly as the ultrasound coupling gel.

### **Instrument**

The researchers reconstructed a questionnaire from the Objective Image Quality Metrics for Ultrasound Imaging (Ilangko

Balasingham, 2009). The questionnaires were distributed to the evaluators to assess the image quality of the ultrasound images.

### Evaluation of Ultrasound Images

Ultrasound Images was evaluated by (3) three consultants and (2) residents in radiology. The criterion for evaluation includes spatial resolution, contrast resolution, and artefacts using a scale of 1 to 3 with 1 being the lowest and 3 the highest.

### Statistical Analysis

All research data was analyzed using chi-square to examine whether there are significant differences between two group means.

## RESULTS AND DISCUSSIONS

**Table 1. Assessment on the Quality of the Ultrasound Image Using Ultrasound Transmission Gel**

Parameter	Evaluator	Mean	Verbal Interpretation
Spatial Resolution	Doctor 1	2.00	Fair
	Doctor 2	1.85	Fair
	Doctor 3	2.05	Fair
	Doctor 4	2.15	Fair
	Doctor 5	1.90	Fair
<b>Composite Mean</b>		<b>1.99</b>	
Artifacts	Doctor 1	2.00	Fair
	Doctor 2	1.75	Fair
	Doctor 3	1.90	Fair
	Doctor 4	1.95	Fair
	Doctor 5	1.85	Fair
<b>Composite Mean</b>		<b>1.89</b>	
Contrast Resolution	Doctor 1	2.00	Fair
	Doctor 2	1.80	Fair
	Doctor 3	1.95	Fair
	Doctor 4	2.05	Fair
	Doctor 5	1.90	Fair
<b>Composite Mean</b>		<b>1.94</b>	

*Note: Images are evaluated by rating the images 1 as lowest rating and 5 as the highest or most satisfying image result*

Table 1 presents the assessment on the quality of ultrasound image using ultrasound transmission gel. It can be gleaned that the mean scores of the doctors are ranging from 1.85-2.00 in terms of spatial resolution. Meanwhile, the mean scores of the evaluators are ranging from 1.75-2.00 with respect

to artifacts and lastly, the mean scores in terms of temporal resolution are ranging from 1.80-.2.05. The result shows a fair performance for ultrasound transmission gel as a coupling medium for ultrasound imaging with a composite mean of 1.94. According to Li et al., 2011, image quality in ultrasound conducted in regional anesthesia is enhanced by using ultrasound gel as a coupling medium between the probe and the patient's skin. Coupling gel produces better images than using water alone.

**Table 2. Assessment on the Quality of the Ultrasound Image Using KY- Jelly**

Parameter	Evaluator	Mean	Verbal Interpretation
Spatial Resolution	Doctor 1	2.75	Good
	Doctor 2	2.35	Fair
	Doctor 3	2.15	Fair
	Doctor 4	2.20	Fair
	Doctor 5	2.50	Good
<b>Composite Mean</b>		<b>2.39</b>	
Artifacts	Doctor 1	2.75	Good
	Doctor 2	2.20	Fair
	Doctor 3	2.00	Fair
	Doctor 4	2.05	Fair
	Doctor 5	2.35	Fair
<b>Composite Mean</b>		<b>2.27</b>	
Contrast Resolution	Doctor 1	2.75	Good
	Doctor 2	2.30	Fair
	Doctor 3	2.10	Fair
	Doctor 4	2.25	Fair
	Doctor 5	2.50	Good
<b>Composite Mean</b>		<b>2.38</b>	

Table 2 presents the assessment on the quality of ultrasound image using KY-Jelly as a coupling medium. It can be gleaned that the mean scores of the evaluators are ranging from 2.15-2.75 with respect to spatial resolution. On the other hand, the mean scores of the doctors are ranging from 2.00-2.75 in terms of artifacts. The mean scores in terms of contrast resolution are ranging from 2.10-2.75. The result shows a fair performance for the KY-Jelly as a coupling medium for ultrasound imaging with a composite mean of 2.38. According to Thomas (2007), KY-Jelly which was patented in 1904 as a surgical lubricant was produced by Johnson & Johnson and introduced in 1919 for personal use as lubricant is hygienic than oil based

lubricant and ultrasound gels. KY-Jelly has high viscosity which minimizes bubble formation and it is water soluble.

**Table 3. Significant Difference in the Rating of the Quality of Ultrasound Image using KY-Jelly and Ultrasound Transmission Gel as Coupling Medium for Ultrasound Imaging**

Parameter	p - value		Decision on H <sub>0</sub>	Verbal Interpretation
Spatial Resolution	0.144	6.857	Not to Reject	Not Significant
Artifacts	0.454	3.656	Not to Reject	Not Significant
Contrast Resolution	0.144	6.857	Not to Reject	Not Significant

Table 3 shows that the quality of ultrasound image using KY-Jelly as a coupling medium has no significant difference with the quality of ultrasound image produced by the standard ultrasound coupling gel. The result also implies that KY-jelly has met the satisfactory standard of coupling medium.

As seen from Table 1, the transmission gel has a fair rate with composite mean of 1.99 for spatial resolution, 1.89 for artifacts and 1.94 for contrast resolution while Table 2 shows that KY-Jelly also gets fair rates of 2.39, 2.27 and 2.38 composite means respectively. Results show that KY- Jelly produces better image quality in ultrasonography than the ultrasound transmission gel. Healy (1970) stated that K-Y Jelly, the water soluble instant jelly marketed by Johnson and Johnson is one of the most ubiquitous products in use in the N.H.S. hospitals. KY-Jelly as stated by Aquino and Francisco 1972 was effectively used as gonioscopy fluid; they found out that clear images were acquired when the transparent K-Y jelly was used with Goldmann three-mirror and Hruby contact lenses.

On the ultrasound image as seen in Figure 1, it can be observed that the sonogram produced by the KY Gel has more clear and detailed structure of the kidney compare to the Transgel. Also the KY Gel produce greater contrast as compared to the sonogram using the commercial transducer gel.



**Figure 1. Ultrasound Image of the Right Kidney**

### **CONCLUSION**

Imaging is one of the highlights in radiologic field. A better image result means an advance understanding of medical solutions. In comparison to Ultrasound Transmission gel as a coupling medium, KY-Jelly shows fair results in terms of spatial resolution, artifacts and contrast resolution. KY-Jelly, relative to the standard ultrasound transmission gel shows better imaging result than the commonly used gel in the medical field. However, the difference on the results of the imaging is not considerably significant.

### **RECOMMENDATION**

The researchers suggest that KY-Jelly be considered one alternative coupling medium for ultrasound imaging. It is also suggested that further review of results may be conducted to establish the potential of KY-Jelly as a coupling medium in ultrasound imaging.

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