Study of Dot Gain in Line and Round Halftone Dot Shapes on Print Quality in Dry Toner Electrophotography for Medical Imaging and Diagnostic Reproduction Systems

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ABSTRACT

Electrophotography is a NIP (Non-Impact Printing) process. This printing process is most commonly used printing process in now a day. The electrophotography printing is based on the halftones. These halftones are available in different dots shapes like Diamond, Elliptical, Square, Line, Round etc. In this research paper, we compare the print quality bases on different dot shapes like Line and Round. The sheets were printed with different halftone dots like Line and Round with the help of dry electrophotography printing process.

Keywords: *Electrophotography, Non-Impact, Halftone Dot, Dot Gain, Diamond, Elliptical, Square, Line, Round.*

I. INTRODUCTION

The xerography or Electrophotography introduced by Chester Carlson in 1938 in New York City. The electrophotography printing process is done in five steps that start from(1) charging a photo receptor belt or drumwith a coroton or scorotron.; (2) exposure with lighta laser beam is used; (3) development the latent image is converted in the real image with the help of the series of black and colored toner cartridge; (4) Transfer the toner on substrateCorotrons rollers are used to transfer the toner on the photoreceptor to the paper electrostatically using the opposite charge of toner;(5) fusing the image on substrate and last step is (6) cleaning of the photoreceptor drum or belt.Halftone is the reprographic system that recreates continuous tone imagery using the dots, differing either in size or in dispersing, in this manner producing an inclination like impact. "Halftone" can likewise be used to refer explicitly to the picture that is created by this procedure. This propagation depends on an essential optical illusion: the small halftone dots are mixed into smooth tones by the human eye.

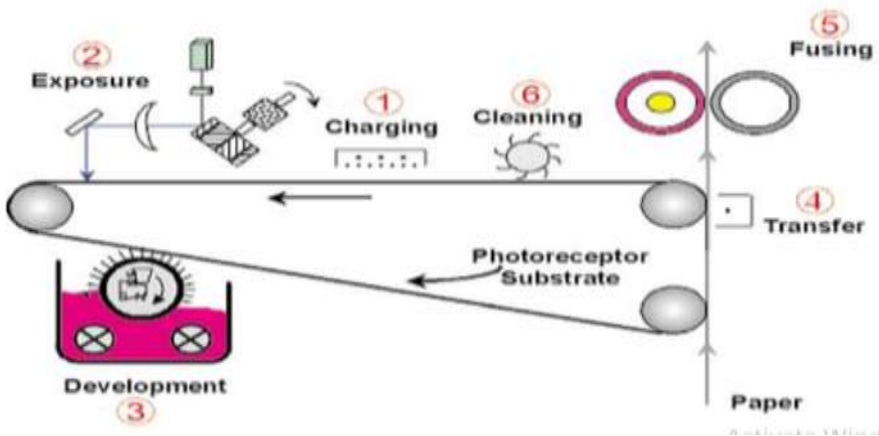

Fig. 1 Schematic diagram of the monochrome xerographic process

A photoreceptor belt is uniformly charged in step (1). An image is written on this belt by a laser in step (2), thereby generating a charge image on the belt. This charge image is converted into a powder image of toner on the belt in the development step (3). This powder image is transferred to a sheet of paper in the transfer step (4) and subsequently fused to the paper in step (5). Residual toner on the photoreceptor is cleaned off in step (6) and the process repeats. Dot gainis increase in the diameter of the halftone dot. There are two types of dot gain (1) Mechanical dot gain, (2) Optical dot gain.

1.1 Mechanical dot gain: - It is a physical growth or loss of the dot. It comes from the presses is called mechanical dot gain.

1.2 Optical dot gain: -Itis the illusion of the dot area it means how the dot appears to the eye on the page is called optical dot gain.

II. RESEARCH OBJECTIVE

To study & analyze the effect of different halftone dots (line and round) on print quality factor of Dot Gain in multi-color Dry Electrophotography digital press.

III. RESEARCH METHODOLOGY

The master chart is with the help of suitable tools and images according to the requirement of theresearch. The sheet was printed with dry toner electrophotography with different dot shapes (line and round).

The sheet is printed in the **"Xerox® Versant® 80 Press"** Dry Toner Electrophotography with suitable conditions and used coated paper

3.1 Specification of Xerox® Versant® 80 Press: -

Speed	Up to 80ppm
Media Weight	52gsm to 350gsm
Media Sizes	Up to 13" * 19.2"
Duty Cycle	460000
Dimensions	860mm(W) * 831mm(D) * 121mm(H)
Weight	295kg
Copy with single-pass duplex scanning	200 images per minutes
Media Types	Coated, Uncoated, Tabs, Envelops etc.

Fig. Master Chart

IV. DATA COLLECTION AND ANALYSIS

Data collection is the main work of the research. The whole research was carried out at**Shree Bala Jee Graphic, Hisar**. The 200 sheetswere printed with dry electrophotography printing process of the different dot shapes (Line

and Round) and first 100 sheets of the line dot shape and last 100 sheets of round dot shape. Data collection is based onevery 5th sheet which is printed by dry electrophotography. The data collected by the x-rite spectrophotometer and the dot gain measured on the 70%, 50% and 20%. After the collection of data, we analyze the data with the help of charts and tables.

4.1 Dot Gain: - It is increase in the diameter of the halftone dot.
Dot gain = a_{print} -a_{form}
Where $a_{print}$is the ink area fraction of the print
$a_{form}$is the prepress area fraction to be inked.
Dot gain is measured of black, yellow, cyan and magenta color at 70%, 50% and 20%.

Table.4.1 Dot Gain in Line and Round Dot Shapes at 70%

DOT GAIN (70%)				
	K	Y	C	M
LINE (Avg.)	69	55	73	80
ROUND (Avg.)	70	55	76	81

Table.4.2 Dot Gain in Line and Round Dot Shapes at 50%

DOT GAIN (50%)				
	K	Y	C	M
LINE (Avg.)	50	32	55	61
ROUND (Avg.)	50	33	55	62

Table.4.3 Dot Gain in Line and Round Dot Shapes at 20%

DOT GAIN (20%)				
	K	Y	C	M
LINE (Avg.)	32	3	22	24
ROUND (Avg.)	27	9	21	25

4.2 Data Analysis
The date obtained from 200 printed sheets and take 5th sheet for measuring the Dot Gain and analyze the data with the help of graphs.

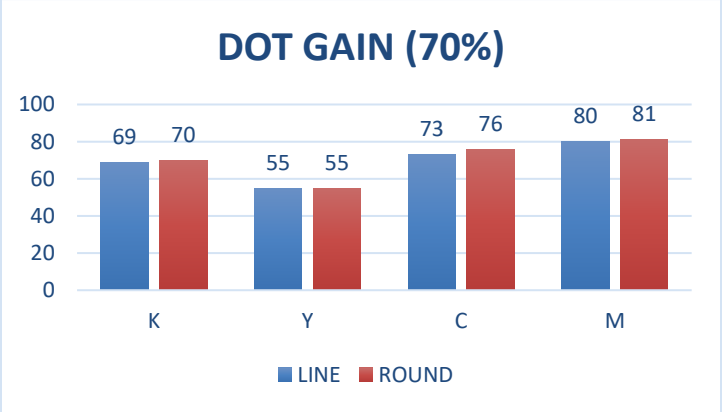

Chart.1 Dot Gain at 70%

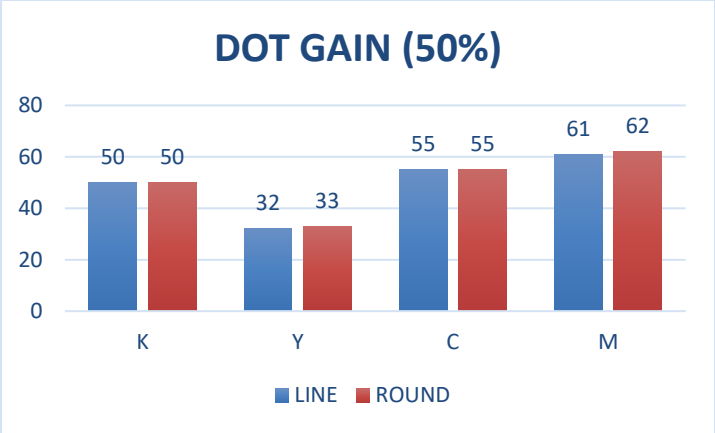

Chart.2 Dot Gain at 50%

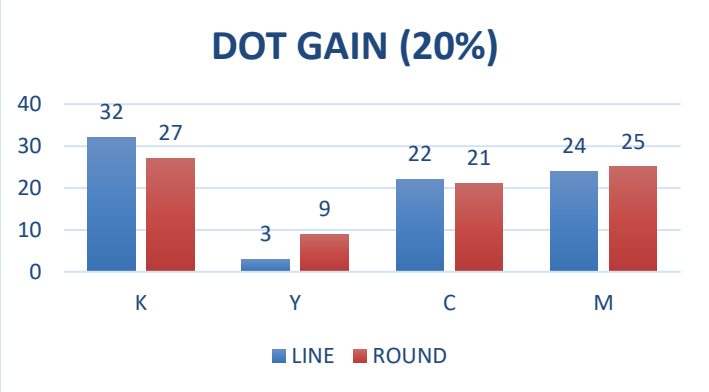

Chart.3 Dot Gain at 20%

V. RESULT AND DISCUSSION

Chart.1 shows that dot gain of black (K) color is near about similar at 70% of line dot and round dot shape. The dot gain of yellow (Y)color is same at 70% of line dot and round dot shape. The dot gain of cyan (C) color is highof round dot shape at 70% as compared to line dot shapes. And the dot gain of magenta (M) color is near about similar at 70% of line dot and round dot shape.
Chart.2 shows that dot gain of black (K) color is same at 50% dot of line dot and round dot shape. The dot gain of yellow (Y) color is near about similar at 50% as of both dot shapes. The dot gain of cyan (C) color is same at 50% of both dot shapes. The dot gain of magenta (M) color is near about similar at 50% of both dots.

Chart.3 shows that dot gain of black (K) color is high at 20% of line dot shape as compared to round dot shapes. The dot gain of yellow (Y) color is high of round dot shape at 20% as compared to line dot shapes. The dot gain of cyan (C) color is near about similar at 20% of both dot shapes. The dot gain of magenta (M) color is color is near about similar at 20% of both dot shapes.

VI. CONCLUSION

In this research we found that the different halftone dot shapes affect the print quality of the printed sheets. In the dot gain in line and round dot shapes the value of c, m, y, k is different at 70%, 50% and 20%. The dot gain of magenta color maximum at 70% as comparison to black, yellow and cyan color in both dot shapes.The dot gain of magenta color is maximum at 50% as comparison to black, yellow and cyan color in both dot shapes. The dot gain of black is maximum at 20% as comparison to yellow, cyan and magenta color in both dot shapes. If the dot gain is high, it causes darker the image and loss of details.

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