

Supporting Efficacy Claims in Clinical Testing with *in vivo* Raman Skin Composition Measurements



I. The technology

In vivo skin composition measurements are now possible using confocal Raman micro-spectroscopy. A dedicated instrument is available that allows for measurements in a clinical setting (see Figure 1).



Figure 1. The River Diagnostics Model 3510 Skin Composition Analyzer.

The ergonomic design of an inverted microscope with a dedicated laser Raman spectrometer allows for measurement of all human skin that can be brought in contact to the microscope window. Laser light is focused on the skin and generates a Raman spectrum. The overall composition of the skin is reflected in this highly specific spectral pattern. This is done at different depths below the surface, see Figure 2.

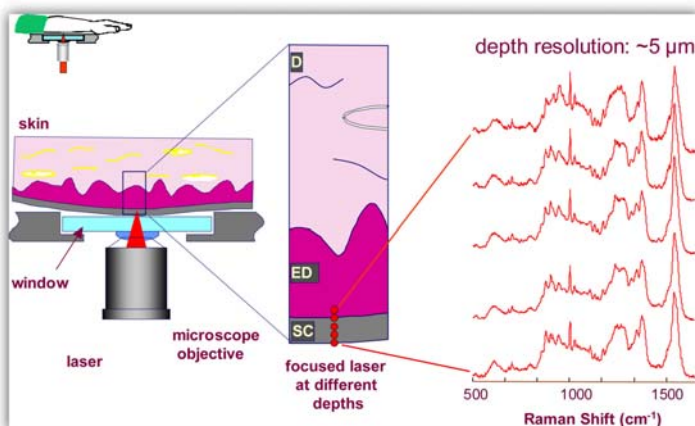


Figure 2. Measurement of the spectra at different depths below the surface of the skin.

Figure 3 illustrates how relevant information may be extracted from the Raman spectra.

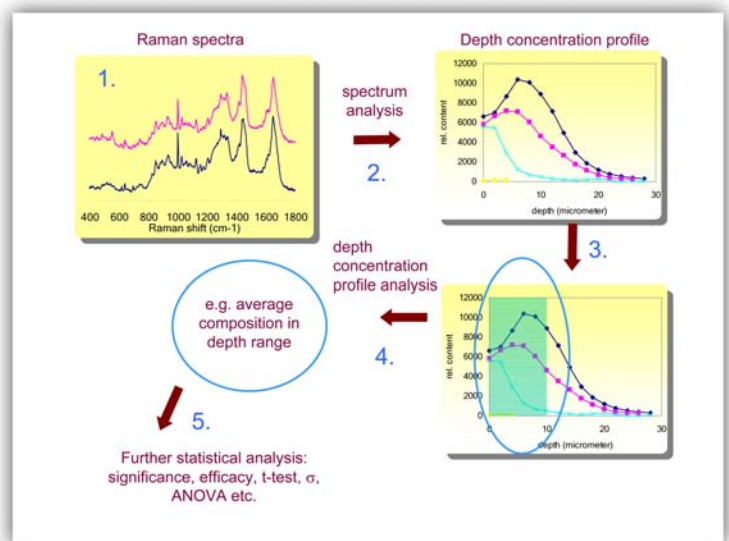


Figure 3. Sample scheme for the conversion of spectra to depth concentration profiles, followed by further analysis and statistical assessment.

II. Sample Clinical Study: Skin Hydration

The *in vivo* skin composition measurements are fast and are being used routinely in panelist studies. Common experimental design considerations also apply to this technology. Typically, repeat measurements are taken, for averaging out biological heterogeneity of the skin.

The schedule in Figure 4 shows a typical experimental design for assessment of the hydration of the stratum corneum. The experiment includes corneometry, TEWL and Raman measurements.

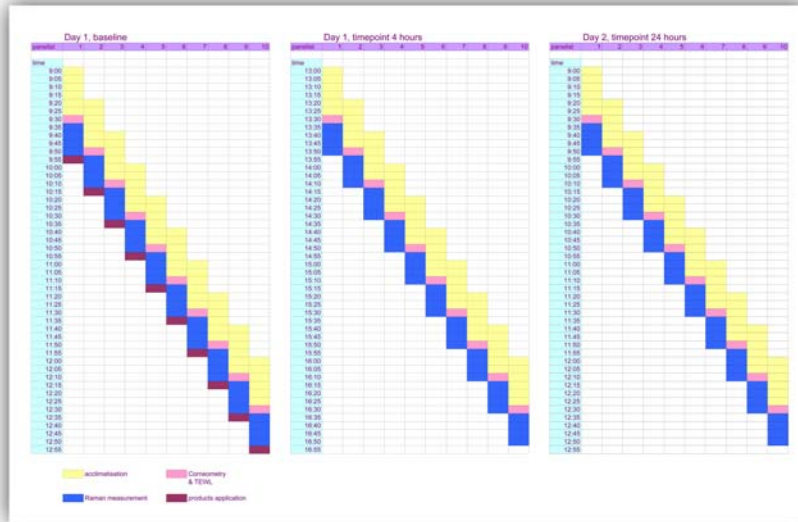
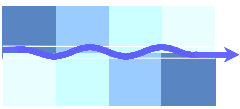


Figure 4. Example experimental time schedule for a moisturization efficacy study

A total of 10 panelists are measured on two application sites (2 different products) and one (untreated) control site. The site assignment is randomized. All measurements are taken at baseline and at 4 and 24 h after product application. All measurements can be done in 1 ½ day.

III. SAMPLE RESULT

Figure 5 shows a sample report. The measured sites are either near the wrist (RL), in the center (RC) or near the elbow (RU) of the right forearm. Two different products are applied (randomized and blinded), the untreated site serves as the control site. The table shows the results

(for example a content of a topically applied active ingredient, or a skin water content), measured at baseline and at 1, 2 and 4 h after application. For each time point the net effect (difference to baseline content) is calculated. Repeat measurements disclose statistical significances (e.g. using a paired t-test). The significances are also indicated in the figure.

The report shows that for each panelist no effect is observed for the control site. The other sites are affected significantly, but for one of the products a clearly lower and less lasting effect is observed.

panelist 1				panelist 2				panelist 3			
timepoint	RU	RC	RL	session	RU	RC	RL	session	RU	RC	RL
0	1284	1198	1153	0	1158	1197	1161	0	1237	1197	1224
1h	1294	1296	1232	1h	1257	1211	1204	1h	1290	1213	1329
net 1h	10	98	79	net 1h	99	14	43	net 1h	53	16	105
2h	1296	1245	1239	2h	1242	1206	1188	2h	1285	1187	1305
net 2h	12	47	86	net 2h	84	9	27	net 2h	48	-10	81
4h	1285	1225	1234	4h	1246	1191	1180	4h	1245	1180	1301
net 4h	1	27	81	net 4h	88	-6	19	net 4h	8	-17	77

statistically significant
 statistically not significant

Figure 5. Sample report of the efficacy of a product, as measured by the River Diagnostics Model 3510 skin composition analyzer.

Head Office
 River Diagnostics BV
 P.O. Box 25229 3001 HE Rotterdam
 The Netherlands
 Tel/Fax +31 10 704 4542/4543
 e-mail info@riverd.com

USA
 River Diagnostics Inc.
 Tel./Fax +1 203 314 8326
 battista@riverd.com

Japan
 Integral Corporation
 Shinjyuku 1-36-7, Shinjyuku-ku Tokyo 160-0022, Japan
 Tel/Fax: +81-3-3353-2630/2672
 www.integral.to