



Food and Drug Administration
2098 Gaither Road
Rockville MD 20850

JUL 24 1997

Thomas M. Tsakeris
President
Devices & Diagnostics Consulting Group
16809 Briardale Road
Rockville, Maryland 20855

Re: K964590
Colormate™
Regulatory Class: II
Product Code: MQM
Dated: May 23, 1997
Received: May 23, 1997

Dear Mr. Tsakeris:

We have reviewed your Section 510(k) notification of intent to market the device referenced above and we have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration.

If your device is classified (see above) into either class II (Special Controls) or class III (Pre-market Approval), it may be subject to such additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 895. A substantially equivalent determination assumes compliance with the current Good Manufacturing Practice requirement, as set forth in the Quality System Regulation (QS) for Medical Devices: General regulation (21 CFR Part 820) and that, through periodic (QS) inspections, the Food and Drug Administration (FDA) will verify such assumptions. Failure to comply with the GMP regulation may result in regulatory action. In addition, FDA may publish further announcements concerning your device in the Federal Register. Please note: this response to your premarket notification submission does not affect any obligation you might have under sections 531 through 542 of the Act for devices under the Electronic Product Radiation Control provisions, or other Federal Laws or Regulations.

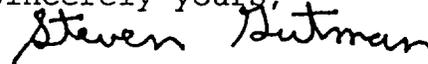
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Under the Clinical Laboratory Improvement Amendments of 1988 (CLIA-88), this device may require a CLIA complexity categorization. To determine if it does, you should contact the Centers for Disease Control and Prevention (CDC) at (770) 488-7655.

This letter will allow you to begin marketing your device as described in your 510(k) premarket notification. The FDA finding of substantial equivalence of your device to a legally marketed predicate device results in a classification for your device and thus, permits your device to proceed to the market.

If you desire specific advice for your device on our labeling regulation (21 CFR Part 801 and additionally 809.10 for in vitro diagnostic devices), please contact the Office of Compliance at (301) 594-4588. Additionally, for questions on the promotion and advertising of your device, please contact the Office of Compliance at (301) 594-4639. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR 807.97). Other general information on your responsibilities under the Act may be obtained from the Division of Small Manufacturers Assistance at its toll-free number (800) 638-2041 or (301) 443-6597 or at its internet address "<http://www.fda.gov/cdrh/dsmamain.html>".

Sincerely yours,



Steven I. Gutman, M.D., M.B.A.
Director
Division of Clinical
Laboratory Devices
Office of Device Evaluation
Center for Devices and
Radiological Health

Enclosure

(510 (K)) Summary

510 (k) SUMMARY
Colormate III™
November 14, 1996

JUL 24 1997

K964590

This summary is provided in accordance with the Safe Medical Devices Act of 1990 (SMDA), at U.S.C. §360c(i)(3) and FDA's implementing regulations, 21 C.F.R. 807.92.

1.0 Submitter of 510(k)

Chromatics Color Sciences International, Inc.
5 East 80th Street
New York, New York 10021-0109

Attention: Ms. Darby S. Macfarlane, CEO

Telephone: 212-717-6544
Facsimile: 212-717-6675

2.0 Name of Device**2.1 Trade/Proprietary Name**

Colormate III™

2.2 Common/Usual Name

Transcutaneous Bilirubinometer (Colorimeter)

2.3 Classification Name

Bilirubin (total and unbound) in the neonate test system (21 CFR 862.1113)

3.0 Reason for Submitting the 510(k)

This 510(k) is being submitted to notify FDA of Chromatics Color Sciences International's (CCSI) desire to commercially distribute for the first time the Colormate III.

4.0 Device Description

The Colormate III™ (Colormate III or CM III) is a computer assisted noninvasive transcutaneous bilirubinometer which, through colorimetric technology, illuminates the skin of newborn babies and measures the yellow content of the skin color. The incremental changes of these color readings measured over time are compared to the newborn's baseline readings. These data are then automatically processed to provide a numerical index of estimated bilirubin count in mg/dl that has been shown to correlate with total serum bilirubin within a clinically useful

range. The Colormate III, like other colorimeters, generates a set of tristimulus color coordinates for each measurement. It then performs a series of algorithms to produce final measurement results.

5.0 Indications for Use & Intended Use

5.1 Indications For Use

The Colormate III is to be used as an aid to the physician in monitoring the status of newborn babies for the development of hyperbilirubinemia. Following the physician's examination within the first hours after birth, newborn babies are initially measured and periodically monitored by the Colormate III for incremental changes in the yellow content of the skin color as compared to the baseline Colormate III measurements. Babies with Colormate III test results indicative of hyperbilirubinemia are to be re-evaluated by the attending physician for appropriate patient management.

5.2 Intended Use

The Colormate III is a computer assisted non-invasive transcutaneous bilirubinometer which, through colorimetric technology, illuminates the skin of newborn babies and measures the yellow content of the skin color. The incremental changes of these color readings measured over time are compared to the newborn's baseline Colormate III readings. These data are then automatically processed to provide a numerical index of predicted bilirubin count in mg/dl that has been shown to correlate with total serum bilirubin concentration within a clinically useful range.

6.0 Substantial Equivalence

The Colormate III is "substantially equivalent" (as defined in 21 U.S.C. § 360c(i)) in principle, performance, and safety and effectiveness to at least two legally marketed predicate devices. The first predicate device, the Unistat Bilirubinometer manufactured by Leica, Inc. (K922770), is a bilirubinometer which operates by measuring the absorption of visible light through a sample of unreacted serum. The absorption at several wavelengths determines the level of bilirubin present in the sample. The second device, the Ingram Icterometer, commercially distributed preenactment (marketed since 1950's) by Cascade Health Care Products, Salem, Oregon, is a noninvasive aid used as a color reference by the physician during his/her visual assessment of the newborn's skin for jaundice or yellowing. The yellow color of the subcutaneous tissue is matched to a corresponding "yellow hue" stripe for a reference score.

The Colormate III and predicate devices can be used as aids in monitoring the development of hyperbilirubinemia in the newborn.

Further, the Colormate III has comparable technological characteristics to those of the predicate devices. The underlying principles of the Colormate III and the predicate devices are the same in that the Colormate III and the predicate devices base their measurements on the unique absorbance characteristics of bilirubin in the visible spectrum. That is, the level of bilirubin (whether intravascular or extravascular) is easily detected by its characteristic absorption of visible light. Bilirubin strongly absorbs light in the wavelengths between approximately 400 to 540 nm. These correspond to the green, blue and violet portions of the visible spectrum. Therefore, an increase in bilirubin is seen as a direct absorption of these colors in transmitted or reflected light or as a relative increase in the complementary color of yellow. This latter effect is seen in the yellowing (jaundice) of the infant's skin during hyperbilirubinemia.

The Colormate III, like the predicate Unistat Bilirubinometer, directly measures the bilirubin concentration via its absorption of visible light. The Colormate III measures the interstitial subcutaneous concentration and the Unistat measures the intravascular concentration.

The Colormate III and the noninvasive predicate device, as well as the visual assessment by the physician, operate on the principle that increasing levels of serum bilirubin during hyperbilirubinemia results in corresponding increases in the level of interstitial bilirubin. The painted stripes of precisely graded yellow hues in the Ingram Icterometer provide the physician with a visual aid to gauge the depth of jaundice in the newborns and estimate the serum bilirubin levels. The Colormate III expands on this concept. The Colormate III replaces the human eye with a colorimeter having more accuracy and precision and provides the physician with a numerical index of estimated serum bilirubin in mg/dl.

7.0 Performance Data

The performance testing provided demonstrates that the Colormate III is statistically significantly more accurate and precise than visual assessment alone and can aid the physician in monitoring hyperbilirubinemia in the newborn. Further, these data demonstrate that the Colormate III interstitial readings are highly correlated ($r = 0.90$, $p < 0.01$) with serum or intravascular bilirubin readings within a clinically useful range.

A series of reproducibility studies were conducted using the Colormate III. Measurements were made using (A) a standard

calibration tile, (B) adult subjects and (C) newborn babies with varying degrees of jaundice. The coefficients of variation (CV) for the tristimulus color coordinates calculated by the Colormate III and used in its numerical index are below 3%.

Prior to undertaking a pivotal clinical trial to evaluate the Colormate III's performance, two phases of studies were conducted to validate the clinical approach and test criteria and determine calibration algorithms for subsequent validation.

A clinical study was conducted to compare (1) the performance of the Colormate III using colorimetric measurement technology to estimate serum bilirubin concentration (BRC) from the yellow content of the color of the skin and (2) the ability of the physician to visually assess the same yellow color of the skin and make a clinical estimate of the BRC. Neonates enrolled in the study underwent the usual course of physical examination (including a visual assessment of the yellowness of the skin for bilirubinemia), monitoring and care. Colormate III skin color measurements, employing a number of anatomical sites on an infant, were made concurrently with serum bilirubin blood tests and physicians' visual estimates.

The trial involved a sequence of 1317 newborns. The study included a mix of the following races: 487 (37%) Caucasians, 298 (23%) Blacks, 427 (32%) Hispanics, 82 (6%) Orientals and 20 (2%) others. One Thousand Thirty-seven (1037) babies were normal (i.e., did not develop hyperbilirubinemia) and, therefore, did not undergo blood serum tests. One Hundred Nine (109) babies did not have initial measurements made within acceptable time frames. The remaining 171 premature and full term newborns with 360 concurrent Colormate III measurements, clinical visual estimates and blood serum tests demonstrated that the Colormate III was better correlated ($p < 0.05$) with serum bilirubin concentration ($r = .90$) than was the clinicians' visual assessment ($r = .67$).

The estimation of bias between the Colormate III test and comparative serum did not exceed 1.6 mg/dl in the clinically useful range of 4.0 to 17.0 mg/dl (less than 1 mg/dl from 7 to 17 mg/dl). In addition, the correlation of Colormate III with serum readings was relatively unaffected by race (Caucasian $r = .91$, Black $r = .88$, Hispanic $r = .89$, Oriental $r = .91$).

Additionally, the relative sensitivities of the visual measurement and the Colormate III results to serum values were computed and compared using a contingency table approach to data presentation and a cutoff of 12.0 mg/dl of bilirubin as an acceptable level of clinical concern. The clinicians' visual assessment agreed above the cutoff of 12.0 with serum only 61% of the time while the Colormate III agreement (sensitivity of the Colormate III) was over 89% in the same patients. The sensitivity of the Colormate III™ was statistically

significantly better than that for the visual assessment, in their correlation to serum values above and below the accepted level of clinical concern of 12.0 mg/dl, $p < .05$. Further, exactly the same conclusions were reached when higher or lower levels were examined (e.g., 8.0 or 14.0). Sensitivity calculations again demonstrated significantly higher sensitivity for the Colormate III than that for the visual assessment.

In conclusion, the Colormate III performance was superior to visual examination in estimating the true level of serum bilirubin, in addition to an excellent correlation to serum bilirubin throughout a clinically useful range.

Indications For Use

Device Name: Colormate III™

Indications For Use:

The Colormate III™ is to be used as an aid to the physician in monitoring the status of newborn babies for the development of hyperbilirubinemia. Following the physician's examination within the first hours of birth, newborn babies are initially measured and periodically monitored by the Colormate III™ for incremental changes in the yellow content of the skin color as compared to the baseline Colormate III™ measurements. Babies with Colormate III™ test results indicative of hyperbilirubinemia are to be re-evaluated by the attending physician for appropriate patient management.

Intended Use:

The Colormate III™ is a computer assisted non-invasive transcutaneous bilirubinometer which, through colorimetric technology, illuminates the skin of newborn babies and measures the yellow content of the skin color. The incremental changes of these color readings measured over time are compared to the newborn's baseline Colormate III™ readings. These data are then automatically processed to provide a numerical index of predicted bilirubin count in mg/dl that has been shown to correlate with total serum bilirubin concentration within a clinically useful range.

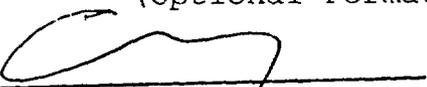
* A rationale for clinical utility is provided on the following page.

(PLEASE DO NOT WRITE BELOW THIS LINE-CONTINUE ON ANOTHER PAGE)

Concurrence of CDRH, Office of Device Evaluation (ODE)

Prescription Use: OR Over-The-Counter:
(Per 21 CFR 801.109)

(Optional Format 1-2-96)



(Division Sign-Off)
Division of Clinical Laboratory Devices
510(k) Number 964590