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# Reproducibility and Reliability of the Wilson-Richmond Categorisation Tool in the Assessment of the Morphological Traits of the Lips

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## ABSTRACT

The aim of this article is to demonstrate the reproducibility of the Wilson-Richmond Categorisation Tool for the assessment of lip morphology. This categorisation system was initially developed as a result of the identification of various morphological features of the vermilion of the lips, following the review of three-dimensional facial scans collected on 2,246 patients (1,095 male and 1,151 female) in a 15-yearold population as part of the Avon Longitudinal Study of Parents and Children. The Wilson-Richmond categorisation tool evaluates the six main areas associated with the lips, namely the philtrum, Cupid's bow, the nasiolabial angle, the upper and lower vermillion and the sub lip region. This tool can be utilised to categorise individuals lip morphology from a topographical perspective and in the assessment and comparison of lip changes that occur during growth. This is the first in a series of papers that will describe the usage of the Wilson-Richmond Categorisation Tool in the assessment of two ethnically different growing populations. The aim of this first article is to demonstrate the reproducibility and reliability of this tool. In this study, Three-dimensional laser scans of (80?) 40 individuals were reviewed and morphologically categorised. In almost all of the classification categories the intra-examiner reliability was greater than the inter-examiner reliability, however both (the intra and inter-examiner reliability) showed high levels of agreement, with the lower double vermillion border and the philtrum width proving to be the most reliable and reproducible categories. The least reliable were the lower vermillion contour and lip-chin shape in both the intra and inter-examiner groups, but these percentage agreements were still sufficiently high enough to indicate good reproducibility and reliability. The intra and inter-examiner percentage agreements were also higher than previously reported figures.

**Conclusion:** This study has shown that the Wilson-Richmond Categorisation Tool is a reproducible and reliable method of assessing the various morphological features of the lips and shows both good inter and intra-examiner reliability. The Wilson-Richmond Categorisation Tool can provide a standardised means of assessment by which further comparisons amongst different, growing, ethnic groups may be compared with a view to identifying population associations. The second paper in this series utilises the WRCT to assess the morphological characteristics of two different ethnic populations of 12-year-old school children.

# Introduction

The lips provide the border to the oral cavity and they have several well-defined functions. They are involved in: the production of sounds, mastication, maintaining an oral seal, providing sensory information about food prior to its placement in the oral cavity, as well as a role in sexual attraction/intimacy. The lips also play a pivotal role not only in verbal, but non-verbal communication. A recent study has also highlighted that children may deploy selective attention to the mouth of a talking face when learning speech [1]. The lips frame the orthodontists work and it is important therefore to understand the effect that not only orthodontics has upon this structure, but also the effect of normal growth, in particular as orthodontic treatment is often undertaken in patients of pubertal age and studies suggests that facial growth continues into adult hood [2]. The necessity to be able to predict accurately growth and the orthodontic affects upon the lips is further reinforced by the fact that the smile is one of the key criteria by which patients judge the success of their own orthodontic treatment [3]. Rains and Nanda [4] highlighted the scarcity of investigations in the published literature on the orthodontic effects upon the soft tissue profile before the 1950's and a similar finding was found by Riolo [5]. In contrast, there has been a considerable amount of research on lip growth following cleft lip and palate repair and changes in lip contour following orthognathic surgery [6-9]. Wilson, et al. [10] further highlighted the scarcity of research that has been undertaken since Rains and Nanda's comments with respect to the vermillion of the lips in a normal population. Studies that have looked into this area

have attempted to describe and classify the traits they have found; for example the three-dimensional study undertaken by Mori, et al. [11] on a small sample of five to six year old children who classified the morphology of the philtrum columns into four types;

- 1. Triangular type,
- 2. Parallel type,
- 3. Concave type and
- 4. Flat type, and the work of a panel of experts for the National Human Genome Research Institute who summarised the anatomy of the oral region and defined and illustrated the terms that describe the major characteristics of the lips, mouth [12], nose and philtrum [13]. Wilson, et al. [10] reviewed the characteristics of lips in a normal 15-yearold population and described the various lip traits and associations present to devise the Wilson-Richmond Categorisation Tool (WRCT). This can be utilised to aid identification of the various morphological features of the lips; it also found that certain morphological features had a high level of association. The WRCT has been used in this study to categorise morphological features of the lips and to demonstrate the reproducibility and reliability of the Wilson-Richmond Categorisation Tool (Figures 1 & 2) in the assessment of various lip traits present in a population sample. A further paper subsequent to this one will apply the WRCT to a population of 12-year-old Welsh school children.

|  | 0              | 1        | 2        | 3        | 4   | 5 | 6 |
|--|----------------|----------|----------|----------|-----|---|---|
|  |                |          | Philt    | rum      |     |   |   |
| Philtrum<br>Shape                          |                | 0        |          | 6        | -   | 0 | 4 |
| Philtrum<br>Width                          |                |          | Ö        |          |     |   |   |
|  |                |          | Cupid    | s Bow    |     |   |   |
| Cupid's Bow<br>Shape                       | -              | $\smile$ | 23       |          |     |   |   |
|  |                |          | Upper V  | ermilion |     |   |   |
| Vermilion<br>Fullness<br>(profile)         | 5              |          |          |          |     |   |   |
| Vermilion<br>border                        | -              | -        |          |          |     |   |   |
| Double<br>Vermilion<br>Border              |                | 12       |          |          |     |   |   |
| Vermilion Brir<br>(profile)                |                | A.       |          |          |     |   |   |
| Vermilion<br>Midline<br>groove/<br>drop    |                |          |          |          |     |   |   |
| Vermilion<br>Contour                       | 2              |          | Nasolabi | al Angle |     |   |   |
| Nasolabial                                 | and the second | 1000     |          | arraigee |     |   |   |
| angle<br>(profile)                         |                |          | Lower Ve | armilion |     |   |   |
| Vermilion                                  |                |          | Lower ve | erminon  |     |   |   |
| Fullness<br>(profile)                      |                |          |          |          |     |   | _ |
| Vermilion<br>border                        |                |          |          |          |     |   |   |
| Double<br>Vermilion<br>Border              |                | 0        |          |          |     |   |   |
| Vermilion<br>groove/<br>bump<br>(3/4 View) |                |          |          |          |     |   |   |
| Vermilion<br>brim<br>(profile)             |                |          |          |          |     |   |   |
| Vermilion<br>Contour                       |                |          | 0        |          |     |   |   |
| Commissure<br>s                            | -              | Ú        |          |          |     |   |   |
|  |                | _        | Su       | ıb-Lip   |     |   | 1 |
| Lip-Chin<br>Shape<br>(profile)             | 1              | 7        |          | 5        | 5   |   |   |
| Mentalis fold                              |                | -        |          |          |     |   |   |
| Lateral<br>muscle tone<br>(3/4 View)       | F              | F        | C        | T        | 1 M |   |   |
| Lower lip<br>tone<br>(looking up)          | 0              | - 2      | AA       |          |     |   |   |

Figure 1: Wilson-Richmond lip categorisation tool.

| Definition         Score           Philtrum width         Three categories based on the width of the philtrum         0 - Narrow           Philtrum width         Devide anywhere from the columelia to the winnillon         1 - Average           Philtrum width         Devide anywhere from the columelia to the winnillon         1 - Average           Progressive scoring of the surface of the philtrum         - Indentation near columelia         - Indentation near columelia           Progressive scoring of the surface of the philtrum         - Indentation near the wermillion border         - Everage groove entroning from columelia to the wermillion border           Cupid's bow         Progressive scoring of the cupid's bow the higher the surface of the philtrum         - Filt           Cupid's bow         Progressive scoring of the fulness of the lips not everation border         0 - Filt           Upper/lower lip         A ribbon of soft tissue matching the vermillion border         0 - None           Upper/lower lip         A ribbon of soft tissue matching the vermillion border         0 - None           Upper/lower lip         A robon of soft tissue matching the vermillion border         1 - Present           Upper/lower lip         A robon of soft tissue deficiency, Drobom point         2 - Forder           Vermillion border         1 - Present         1 - Mediam           Upper/lower lip         Vermetin the obset from sof midl  |   |  |   |
|--|---|--|---|
| based anywhere from the columelia to the vermillion<br>Philtrum width         2 - Wide           Philtrum width         border.         2 - Wide           0 - Smooth philtrum         0 - Smooth philtrum         0 - Smooth philtrum           1 - Normal gradient         2 - Indentation near columelia         0 - Smooth philtrum           1 - Normal gradient         3 - Deeg grove ranning from columelia to the<br>of the largest indention from the columelia to the<br>indentification rate the vermillion border           Cupid's bow         Progressive scoring of the fullness of the largest indentification in the middle<br>of the largest indentification in the indentin the indentification in the indentification in the  |   | Definition   | Score   |
| based anywhere from the columelia to the vermillion<br>Philtrum width         2 - Wide           Philtrum width         border.         2 - Wide           0 - Smooth philtrum         0 - Smooth philtrum         0 - Smooth philtrum           1 - Normal gradient         2 - Indentation near columelia         0 - Smooth philtrum           1 - Normal gradient         3 - Deeg grove ranning from columelia to the<br>of the largest indention from the columelia to the<br>indentification rate the vermillion border           Cupid's bow         Progressive scoring of the fullness of the largest indentification in the middle<br>of the largest indentification in the indentin the indentification in the indentification in the  |   |  |   |
| based anywhere from the columelia to the vermillion<br>Philtrum width         2 - Wide           Philtrum width         border.         2 - Wide           0 - Smooth philtrum         0 - Smooth philtrum         0 - Smooth philtrum           1 - Normal gradient         2 - Indentation near columelia         0 - Smooth philtrum           1 - Normal gradient         3 - Deeg grove ranning from columelia to the<br>of the largest indention from the columelia to the<br>indentification rate the vermillion border           Cupid's bow         Progressive scoring of the fullness of the largest indentification in the middle<br>of the largest indentification in the indentin the indentification in the indentification in the  |   |  |   |
| Philtrum width         border.         2 - Wide           Progressive scoring of the surface of the philtrum in<br>terms of the smoothness of the surface of the philtrum in<br>of the largest indention from the columella to the<br>philtrum wermillion border.         - Indentiation in the middle           Logari's bow         Progressive scoring of the Cupid's bow the higher the<br>score the mean angulated the Cupid's bow         0 - Flat           Cupid's bow         Progressive scoring of the fullness of the largest<br>indentiation from the cupid's bow.         0 - Flat           Progressive scoring of the fullness of the largest<br>indentiation border.         0 - Flat         - Indentiation interming the vermillion border.           Cupid's bow         Progressive scoring of the fullness of the largest<br>indentiation border.         0 - Flat         - Ushaped           Cupid's fullness         profile).         0 - Flat         - Stapped         - Stapped           Upper/lowerlip         A ribboo of soft tisse matching the vermillion border.         - None         - None           Upper/lowerlip         A small semi-circular projection at the vermillion border.         - None         - None           Upper/lowerlip         A small semi-circular projection at the vermillion border.         - None         - None           upper/lowerlip         The presence of different forms of midline variation.         - None         - None           upper/lowerlip         The stappe o  |   | -  |   |
| Upper/lower lip<br>vermition motion<br>bodrer         0 - Smooth philtrum         0 - Smooth philtrum           Progressive scoring of the surface of the philtrum in<br>of the arget indento from the columel is to the<br>vermition bodrer.         0 - Regressive scoring of the curicase and the position<br>of the arget indento from the columel is to the<br>vermition bodrer.         0 - Fist           Cupid's bow         Progressive scoring of the fullness of the lips not<br>exernition to full ages, for the full bodrer.         0 - Fist           Upper/lower lip<br>vermition full<br>bodre         Progressive scoring of the fullness of the lips not<br>exernition bodrer.         0 - Fist           Upper/lower lip<br>vermition full bodred         0 - None         0 - None           Upper/lower lip<br>vermition full bodred         0 - None         0 - None           Upper/lower lip<br>vermition full bodred         0 - None         0 - None           Upper/lower lip<br>vermition full bodred         0 - None         0 - None           Upper/lower lip<br>vermition full bodred         0 - None         0 - None           Upper/lower lip<br>vermition full bodred regress, such efficients of midline variation<br>notot/doop         0 - None         0 - None           Upper/lower lip<br>vermition full bodred regress, such efficients, Drom bodred regress, such efficients, Drom the lower lip<br>Notot grooped area (tissue excess).         0 - None         0 - None           Upper/lower lip<br>vermition fulls         0 - State         0 - State         0 - State   |   |  |   |
| Progressive scoring of the surface of the philtrom         1. Hormal gradient           Indentation of the surface of the philtrom         2. Indentation near the vermillion border           of the largest indention from the columella to the columella to the vermillion border.         4. Indentation of the vermillion border           Cupid's bow         Progressive scoring of the Cupid's bow         0. Fat.           Progressive scoring of the Cupid's bow         0. Fat.         0. Fat.           Progressive scoring of the Cupid's bow         0. Thin         1. Vendum           Vendum         progressive scoring of the Cupid's bow         0. Thin           Vendum         1. Vendum         1. Vendum           Vendum         progressive scoring of the fulness of the lips not         0. Thin           Vendum         1. Vendum         1. Vendum           Vendum         A rubon of soft issue matching the vermillion border         0. None           Upper/lower lip         A small semi-circular projection at the vermillion border         0. None           Upper/lower lip         Vendum         0. None         1. Notadia           Vendum         A small semi-circular projection at the vermillion border         0. None           Upper/lower lip         Vendum         0. None         1. Notadia           Venore         1. Notadia         0. N   | Philtrum width  | border.  | 2 - Wide  |
| Progressive scoring of the surface of the philtrom         1. Hormal gradient           Indentation of the surface of the philtrom         2. Indentation near the vermillion border           of the largest indention from the columella to the columella to the vermillion border.         4. Indentation of the vermillion border           Cupid's bow         Progressive scoring of the Cupid's bow         0. Fat.           Progressive scoring of the Cupid's bow         0. Fat.         0. Fat.           Progressive scoring of the Cupid's bow         0. Thin         1. Vendum           Vendum         progressive scoring of the Cupid's bow         0. Thin           Vendum         1. Vendum         1. Vendum           Vendum         progressive scoring of the fulness of the lips not         0. Thin           Vendum         1. Vendum         1. Vendum           Vendum         A rubon of soft issue matching the vermillion border         0. None           Upper/lower lip         A small semi-circular projection at the vermillion border         0. None           Upper/lower lip         Vendum         0. None         1. Notadia           Vendum         A small semi-circular projection at the vermillion border         0. None           Upper/lower lip         Vendum         0. None         1. Notadia           Venore         1. Notadia         0. N   |   |  |   |
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| Progressive scoring of the surface of the philtrum in<br>philtrum         2 - indentation near columelia<br>3 - indentation in the middle<br>2 - support of the largest indention from the columelia to the<br>wermillion border.         4 - indentation near the vermillion border.           Cupid's bow         Progressive scoring of the Cupid's bow the higher the<br>score the more angulated the Cupid's bow.         0 - Fiat           Cupid's bow         Score the more angulated the Cupid's bow.         0 - Thin           Upper/lower lip<br>vermillion fullness         0 - Thin         0 - Thin           Upper/lower lip<br>vermillion fullness         0 - Thin         0 - Thin           Upper/lower lip<br>vermillion fullness         0 - None         0 - None           Upper/lower lip<br>vermillion border         0 - None         0 - None           Upper/lower lip<br>vermillion border         0 - None         0 - None           Upper/lower lip<br>vermillion border         0 - None         0 - None           Upper/lower lip<br>vermillion border         0 - None         0 - None           Upper/lower lip<br>vermillion border         0 - None present         0 - None           Upper/lower lip<br>vermillion border         0 - None present         0 - None           Upper/lower lip<br>vermillion border         0 - None present         0 - None           Upper/lower lip<br>vermillion border         0 - None present         0 - None           Upp  |   |  |   |
| Progressive scoring of the surface of the philtmun         1 - identitation in the middle           Indentitation of the argest indention from the columella to the position         2 - beerg prozee running from columella to the vermillion border           Cupid's bow         Progressive scoring of the Cupid's bow         0 - Fat           Cupid's bow         Score the more angulated the Cupid's bow.         0 - Fat           Progressive scoring of the Cupid's bow         0 - Thin         0 - Thin           Upper/lower lip         Progressive scoring of the fulness of the lips not extending beyond the vermillion border (viewed in the vermillion border viewed in the vermillion border         0 - Thin           Upper/lower lip         A ribbo of soft its use matching the vermillion border         0 - None           Upper/lower lip         A ribbo of soft its use matching the vermillion border         0 - None           Upper/lower lip         A ribbo of soft its use matching the vermillion border         0 - None           Upper/lower lip         A ribbo of soft its use matching the variable coverage, 2 - full border         0 - None           Upper/lower lip         The presence of different forms of midline variation in the indifferent forms of midline variation in the indifference         0 - None           Nasolabial Angle         Oclumella angle which can be 90 degrees, acut or difference         0 - None         0 - None           Columella angle which can be 90 degrees, acut  |   |  |   |
| Progressive scoring of the surface of the philtrum in terms of the surface and the position         4  |   |  |   |
| terms of the smoothness of the surface and the position<br>of the largest indention from the columella to<br>the vermillion border.         5-Beg groove sunning from columella to<br>the vermillion border.           Cupid's bow         6-Desp groove standing through the vermillion border.           Cupid's bow         9-Fogressive scoring of the Cupid's bow.           Upper/lower lip<br>vermillion fullness         0-Thin           Progressive scoring of the fullness of the lips not<br>extending beyond the vermillion border (viewel)         0-Thin           Upper/lower lip<br>vermillion fullness         0-Thin           Upper/lower lip<br>vermillion fullness         0-Thin           Upper/lower lip<br>vermillion fullness         0-None           Upper/lower lip<br>vermillion border         A nall semi-circular projection at the vermillion border         0-None           Upper/lower lip<br>vermillion border         A nanall semi-circular projection at the vermillion border         0-None           Upper/lower lip<br>vermillion border         1- Media         1- Media           Upper/lower lip<br>vermillion border         1- Media         1- Middle           Upper/lower lip<br>vermillion border         1- Media         1- Middle           Upper/lower lip<br>vermillion border         1- Media         1- Middle           Upper/lower lip<br>vermillion border         1- Media         1- Media           Upper/lower lip<br>vermillion border         1- Media <td></td> <td></td> <td></td>  |   |  |   |
| Indentation of the larges indention from the colonella to the vermillion border.<br>by evermillion border.<br>Cupid's bow vermillion border (viewed in expander be upid's bow.<br>Cupid's bow score the more angulated the Cupid's bow.<br>Cupid's bow score the more angulated the Cupid's bow.<br>Progressive scoring of the fulnes of the lips not extending beyond the vermillion border (viewed in 2 - Sharp V<br>Upper/lower lip double vermillion border (viewed in 2 - Sharp V<br>Upper/lower lip double vermillion border (viewed in 2 - Thick<br>Upper/lower lip double vermillion border (viewed in 2 - Thick<br>Upper/lower lip double vermillion border (viewed in 2 - Thick<br>Upper/lower lip double vermillion border (viewed in 2 - Thick<br>Upper/lower lip double vermillion border (viewed in 2 - Thick<br>Upper/lower lip double vermillion border (viewed in 2 - Thick<br>Upper/lower lip vermillion the border at the vermillion border (viewed in 2 - Thetent<br>Upper/lower lip double vermillion lip border with variable coverage 2 - Full border<br>vermillion border to the vermillion border (viewed in 2 - Thetent<br>Upper/lower lip vermillion horder (viewed in 2 - Thetent<br>Upper/lower lip vermillion high border with variable coverage 2 - Full border<br>Nasolabial Angle colume area (tissue excess).<br>Nasolabial Angle colume area (tissue excess).<br>Nasolabial Angle colume area (tissue excess).<br>Upper lip vermillion midline border from the Cupid's box<br>contour peaks to the commissures.<br>Pronounced mentals<br>Nasolabial Angle vermillion border to the dhin.<br>Nasolabial Angle vermillion of the commissures in relation to the general lip - Straight<br>Lower lip vermillion of the commissures in relation to the general lip - Straight<br>Lower lip vermillion different forms in relation to the general lip - Straight<br>Lower lip vermillion di the commissures in relation to the general lip - Straigh   |   |  |   |
| philtrum         Inclusion for the coupid's bow         Image: coupid's bow <thimage: bow<="" coupid's="" th="">         Image: coupid's bow         <thimage: bow<="" coupid's="" th=""> <thimage: bow<="" coupid's="" th=""></thimage:></thimage:></thimage:>  |   |  |   |
| Cupid's bow         Progressive scoring of the Cupid's bow.         0 - flat           Upper/lower lip         extending beyond the vermillion border (viewed in lar. Medium         1 - Medium           Upper/lower lip         Progressive scoring of the fullness of the lips not extending beyond the vermillion border (viewed in lar. Medium         0 - Thin           Upper/lower lip         Progressive scoring of the fullness of the lips not extending beyond the vermillion border         0 - Thin           Upper/lower lip         extending beyond the vermillion border         0 - None           Upper/lower lip         A ribbon of soft tissue matching the vermillion border         0 - None           Upper/lower lip         A small semi-circular projection at the vermillion border         0 - None           Upper/lower lip         the presence of different forms of midline variation.         1 - Present           Upper/lower lip         the presence of different forms of midline variation.         2 - Full border           Upper lip vermillion border         area (tissue excess).         0 - None gresent           1 - Notch in midline         2 - Sunche dmass in midline           0 - None gresent         1 - Notch in midline           1 - Notch in midline         2 - Outofer dmass in midline           1 - Notch in midline         2 - Outofer           1 - Notch in midline         2 - Outofer  |   | ÷  |   |
| Progressive scoring of the Cupid's bow.         1-U-shaped           Cupid's bow         2-Sharp V           Upper/lower lip         extending beyond the vermilion border (viewed)         0. Thin           Upper/lower lip         extending beyond the vermilion border (viewed)         0. Think           Upper/lower lip         double vermilion         0. None           Upper/lower lip         a small semi-circular projection at the vermillion border         0. None           Upper/lower lip         xemilion line         0. None           Upper/lower lip         xemilion border         0. None           Upper/lower lip         xemilion border         0. None           Upper/lower lip         xemilion lip border with variable coverage         2. Full border           Upper/lower lip         the presence of different forms of midline variation.         1. Notch in midline           vermillion border         the presence of different forms of midline variation.         1. Notch in midline           notch/drop         area (tissue excess).         2. Full border         2. Full border           Upper lip vermillion         the spee of the vermillion border from the Cupit's bow         2. Obuse         0. Acute           Upper lip vermillion         pressing the commissures.         3. Procopy midline         3. Anoreal           Upper lip   | philtrum  | vermillion border.   | 6 – Deep groove extending through the vermillion border |
| Progressive scoring of the Cupid's bow.         1-U-shaped           Cupid's bow         2-Sharp V           Upper/lower lip         extending beyond the vermilion border (viewed)         0. Thin           Upper/lower lip         extending beyond the vermilion border (viewed)         0. Think           Upper/lower lip         double vermilion         0. None           Upper/lower lip         a small semi-circular projection at the vermillion border         0. None           Upper/lower lip         xemilion line         0. None           Upper/lower lip         xemilion border         0. None           Upper/lower lip         xemilion border         0. None           Upper/lower lip         xemilion lip border with variable coverage         2. Full border           Upper/lower lip         the presence of different forms of midline variation.         1. Notch in midline           vermillion border         the presence of different forms of midline variation.         1. Notch in midline           notch/drop         area (tissue excess).         2. Full border         2. Full border           Upper lip vermillion         the spee of the vermillion border from the Cupit's bow         2. Obuse         0. Acute           Upper lip vermillion         pressing the commissures.         3. Procopy midline         3. Anoreal           Upper lip   |   |  |   |
| Cupid's bow         2 - Sharp V           Upper/lower lip         Progressive scoring of the fullness of the lips not<br>extending beyond the vermillion border (viewed in<br>porfile).         0 - Thin           Upper/lower lip         A shabon of soft tissue matching the vermillion border         0 - None           Upper/lower vermillion fullness         0 - None         0 - None           Upper/lower vermillion border         0 - None         0 - None           Upper/lower vermillion border         0 - None         0 - None           Upper/lower vermillion border         0 - None         0 - None           Upper/lower vermillion border         0 - None         0 - None           Upper/lower vermillion border         0 - None         0 - None           Upper/lower lip         The presence of different forms of midline variation.         1 - Modela           vermillion midline         Notch: grooved area (tissue excess).         0 - None groop midline           Nasolabial Angle         0 - Stote         0 - Octose           0 - Stote         0 - Octose         0 - Octose           1 - Wermillion border of the sub lip area, from the Cupid's bow         2 - Corvex           0 - Korte         0 - Cortes         0 - Cortes           1 - Straight         0 - Octose         0 - Fist           1 - Corvest of the sub lip area, fro  |   | Dreamenting searing of the final distance in the birth out   |   |
| Upper/lower lip         Progressive scoring of the fullness of the lips not<br>extending beyond the vermillion border (viewed in<br>1 - Medium         0 - Thin           Upper/lower lip         A ribbon of soft tissue matching the vermillion border         0 - None           Upper/lower lip         A ribbon of soft tissue matching the vermillion border         0 - None           Upper/lower lip         A ribbon of soft tissue matching the vermillion border         0 - None           Upper/lower lip         A small semi-circular projection at the vermillion border.         1 - Present           Upper/lower lip         The presence of different forms of midline variation.         0 - None           vermillion midline         notch/drop         0 - None eint           vermillion midline         area (tissue excess).         0 - None present           Upper/lower lip         The presence of different forms of midline variation.         2 - Burched mass in midline           notch/drop         area (tissue excess).         0 - Otopy midline           Note:         columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion         the shape of the vermillion border from the Cupid's bor<br>pasks to the commissures.         0 - Flat           Lower lip-chin shape         Presence of an obvious mental fold.         1 - Present           fold         Presence of an obvious mental fold.   | Cupid to have   |  |   |
| Upper/lower lip<br>overmilion fullness         extending beyond the vermillion border (viewed in<br>profile).         1 - Medium           upper/lower lip<br>double vermillion<br>border         A ribbon of soft tissue matching the vermillion border.         0 - None           upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           upper/lower<br>vermillion border         0 - None         0 - None           upper/lower<br>vermillion border         0 - None         0 - None           upper/lower lip<br>vermillion border         0 - None         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None present           upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.         0 - None present           natch/drop         area (tissue excess).         3 - Drocoy midline         0 - Acute           columella angle which can be 90 degrees, acute or<br>contour         0 - Concave         0 - Concave           upper lip vermillion         the shape of the vermillion border from the Cupid's bow         2 - Obtuse           upper lip vermillion         the curvature of the sub lip area, from the lower lip         1 - Conreav     <   | Cupid's bow   | score the more angulated the Cupid's bow.  | 2 – Sharp V   |
| Upper/lower lip<br>overmilion fullness         extending beyond the vermillion border (viewed in<br>profile).         1 - Medium           upper/lower lip<br>double vermillion<br>border         A ribbon of soft tissue matching the vermillion border.         0 - None           upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           upper/lower<br>vermillion border         0 - None         0 - None           upper/lower<br>vermillion border         0 - None         0 - None           upper/lower lip<br>vermillion border         0 - None         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None present           upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.         0 - None present           natch/drop         area (tissue excess).         3 - Drocoy midline         0 - Acute           columella angle which can be 90 degrees, acute or<br>contour         0 - Concave         0 - Concave           upper lip vermillion         the shape of the vermillion border from the Cupid's bow         2 - Obtuse           upper lip vermillion         the curvature of the sub lip area, from the lower lip         1 - Conreav     <   |   |  |   |
| Upper/lower lip<br>overmilion fullness         extending beyond the vermillion border (viewed in<br>profile).         1 - Medium           upper/lower lip<br>double vermillion<br>border         A ribbon of soft tissue matching the vermillion border.         0 - None           upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           upper/lower<br>vermillion border         0 - None         0 - None           upper/lower<br>vermillion border         0 - None         0 - None           upper/lower lip<br>vermillion border         0 - None         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None           upper/lower lip<br>vermillion border         1 - Mediue         0 - None present           upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.         0 - None present           natch/drop         area (tissue excess).         3 - Drocoy midline         0 - Acute           columella angle which can be 90 degrees, acute or<br>contour         0 - Concave         0 - Concave           upper lip vermillion         the shape of the vermillion border from the Cupid's bow         2 - Obtuse           upper lip vermillion         the curvature of the sub lip area, from the lower lip         1 - Conreav     <   |   | Brownship coulor of the full and the literation  | 0 7510  |
| vermillion fullness profile). 2 - Thick<br>Upper/lower lip<br>double vermillion is a ribbon of soft tissue matching the vermillion border<br>usually lying zmm above the border. 1 - Present<br>Upper/lower<br>vermillion brim A small semi-circular projection at the vermillion border. 1 - Present<br>Upper/lower lip<br>vermillion border<br>Upper/lower lip<br>vermillion motifie<br>notch/drop<br>notch/drop<br>Nasolabial Angle<br>Lower lip-chin shape<br>Pronounced mentalis<br>fold<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Contour<br>Contour<br>Contour<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissures<br>Commissure | Henry Harrison  |  |   |
| Upper/lower lip<br>double vermillion<br>border         A ribbon of soft tissue matching the vermillion border         0 - None           Upper/lower<br>vermillion brim         A sibbon of soft tissue matching the vermillion border         0 - None           Upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           Upper/lower lip<br>vermillion border         A small semi-circular projection at the vermillion border.         0 - None           Upper/lower lip<br>vermillion border         Identifiable vermillion border with variable coverage.         2 - Full border           Upper/lower lip<br>vermillion midline<br>notch/drop         The presence of different forms of midline variation.         0 - None present           Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute         0 - Acute           Upper lip vermillion<br>contour         peaks to the commissures.         0 - Concave         0 - Concave           1 - Straight         2 - Obtuse         0 - Flat         0 - Flat           Lower lip-chin shape         vermillion border to the chin.         0 - Note greent         0 - Note yet angle to concavity           2 - Connexe         0 - Flat         0 - Note yet angle to concavity         0 - Not present           Lower lip-chin shape         In extrained to the general lip.         0 - Not present         0 - Upturned   |   |  |   |
| double vermillion<br>border         A ribbon of soft tissue matching the vermillion border<br>usually lying 2mm above the border.         0 - None           Upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           Upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           Upper/lower<br>vermillion border         I - Present         0 - None           Upper/lower lip<br>vermillion midline         I - Present         0 - None           Upper/lower lip<br>vermillion midline         I - Present         0 - None           National set is proved area (tissue deficiency): Drop: burder         0 - None present         0 - None           1 - Notch in midline         0 - None present         0 - None present         0 - None           1 - Notch in midline         0 - None present         0 - None present         0 - None           1 - Notch in midline         0 - None         0 - None         0 - None           1 - Notch in midline         0 - None         0 - None         0 - None           1 - Notch in midline         0 - None         0 - None         0 - None           1 - Normal         0 - None         0 - None         0 - None           1 - Straight         0 - None         0 - Concave         0 - Straight <td< td=""><td></td><td>profile).</td><td>z - Inick</td></td<>   |   | profile).  | z - Inick   |
| border         usually lying 2mm above the border.         1 - Present           Upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           Upper/lower lip         - None         -           vermillion border         identifiable vermillion lip border with variable coverage.         2 - Full Border           Upper/lower lip         The presence of different forms of midline variation.         -         None metails           vermillion midline         The presence of different forms of midline variation.         -         None present           vermillion midline         -         -         -         None metails           notch/drop         area (tissue excess).         -         -         -         -           Vasolabial Angle         Columella angle which can be 90 degrees, acute or<br>columella angle which can be 90 degrees, acute or<br>colume         -         -         -         -         -           Upper lip vermillion         The shape of the vermillion border from the Cupid's bove         -         -         -         -           Upper lip-chin shape         vermillion border to the chin.         -         -         -         -           Lower lip-chin shape         versence of an obvious mental fold.         -         -         -         -   |   |  | A No  |
| Upper/lower<br>vermillion brim         A small semi-circular projection at the vermillion border.         0 - None           Upper/lower<br>vermillion brider         1 - Present         0 - None           Upper/lower<br>vermillion border         1 - Model         0 - None           Upper/lower<br>vermillion border         1 - Model         0 - None           Upper/lower<br>vermillion midline         The presence of different forms of midline variation.<br>Notch: grooved area (tissue decisency); Drop: bumped         0 - None present           0 - None         1 - Motch in midline         2 - Bunched mass in midline           0 - None         1 - Notch in midline         2 - Bunched mass in midline           0 - Acute         0 - Acute         1 - Normal           0 - Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Concave         1 - Straight           0 - Concave         1 - Straight         0 - Concave         1 - Straight           1 - Upper lip vermillion         The shape of the vermillion border from the Cupid's bow         2 - Convex         0 - Flat           1 - Curved concavity         3 - Marked angular concavity         3 - Angular concavity         4 - Marked angular concavity           1 - Wermillion border to the chin.         0 - Not present         0 - Not present         0 - Nore en           1 - Convex         1 - Present         0 - Nore mindiline  |   |  |   |
| vermillion brim         A small semi-circular projection at the vermillion border.         1 - Present           Upper/lower lip<br>vermillion border         0 - None         1 - Middle           Upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.<br>Notch: grooved area (tissue excess).         0 - None present           0 - None present         1 - Notch in midline         1 - Notch in midline           0 - None present         1 - Notch in midline         2 - Bunched mass in midline           0 - None present         1 - Notch in midline         2 - Bunched mass in midline           0 - None present         1 - Notch in midline         2 - Bunched mass in midline           0 - Acute         1 - Normal         2 - Otruse           0 - Otruse         2 - Otruse         2 - Concave           1 - Straight         2 - Convex         2 - Convex           0 - Flat         1 - Curved concavity         3 - Pseudo-convex           0 - Not present         0 - Not present         2 - Agular concavity           1 - Curvet concavity         3 - Pseudo-convex         3 - Pseudo-convex           0 - Flat         1 - Curvet concavity         3 - Marked angular concavity, with a convex area           0 - Not present         1 - Straight         1 - Straight         3 - Straight           1 - Gurver dorn dorito  | border  | usually lying 2mm above the border.  | 1 - Present   |
| vermillion brim         A small semi-circular projection at the vermillion border.         1 - Present           Upper/lower lip<br>vermillion border         0 - None         1 - Middle           Upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.<br>Notch: grooved area (tissue excess).         0 - None present           0 - None present         1 - Notch in midline         1 - Notch in midline           0 - None present         1 - Notch in midline         2 - Bunched mass in midline           0 - None present         1 - Notch in midline         2 - Bunched mass in midline           0 - None present         1 - Notch in midline         2 - Bunched mass in midline           0 - Acute         1 - Normal         2 - Otruse           0 - Otruse         2 - Otruse         2 - Concave           1 - Straight         2 - Convex         2 - Convex           0 - Flat         1 - Curved concavity         3 - Pseudo-convex           0 - Not present         0 - Not present         2 - Agular concavity           1 - Curvet concavity         3 - Pseudo-convex         3 - Pseudo-convex           0 - Flat         1 - Curvet concavity         3 - Marked angular concavity, with a convex area           0 - Not present         1 - Straight         1 - Straight         3 - Straight           1 - Gurver dorn dorito  |   |  |   |
| Upper/lower lip<br>vermillion border         identifiable vermillion lip border with variable coverage.         0 - None           Upper/lower lip<br>vermillion midline<br>notch/drop         The presence of different forms of midline variation.<br>Noth: grooved area (tissue deficiency): Drop: bumped<br>area (tissue excess).         0 - None present           Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Columella angle which can be 90 degrees, acute or<br>contour         0 - Acute           Upper lip vermillion<br>contour         0 - the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concex           1 - Noter document         0 - Convex         0 - Convex           2 - Convex         3 - Precode convex           0 - Concave         1 - Straight           1 - Curve docnavity         2 - Angular concavity           2 - Angular concavity         3 - Marked angular concavity, with a convex area           0 - Not present         1 - Present           1 - Warred in midline         1 - Straight           1 - Overed         0 - Not present           1 - Warred concavity         2 - Angular concavity, with a convex area           0 - Not present         1 - Present           1 - Present         2 - Conved           2 - Conved         2 - Conved           2 - Conved         2 - Conved <td></td> <td></td> <td></td>  |   |  |   |
| Upper/lower lip<br>vermillion border         1 - Middle           Upper/lower lip<br>vermillion midline<br>notch/drop         The presence of different forms of midline variation.<br>notch/drop         0 - None present           Upper/lower lip<br>vermillion midline<br>notch/drop         The presence of different forms of midline variation.<br>notch/drop         0 - None present           Vasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion<br>contour         0 - Acute         1 - Notch in midline           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave           1 - Curved concavity         2 - Obuse-<br>0 - Flat         2 - Onvex           1 - Curved concavity         2 - Angular concavity         2 - Angular concavity           2 - Not present         0 - Not present         0 - Flat           1 - Curved concavity         2 - Angular concavity         2 - Angular concavity           2 - Marked angular concavity         2 - Angular concavity         2 - Angular concavity           2 - Marked angular concavity         2 - Marked angular concavity, with a convex area           0 - Not present         0 - Not present         0 - Upturned           1 - Curved         0 - Nore         1 - Straight         0 - Nore           1 - Straight         0  | vermillion brim   | A small semi-circular projection at the vermillion border.   | 1 - Present   |
| Upper/lower lip<br>vermillion border         1 - Middle           Upper/lower lip<br>vermillion midline<br>notch/drop         The presence of different forms of midline variation.<br>notch/drop         0 - None present           Upper/lower lip<br>vermillion midline<br>notch/drop         The presence of different forms of midline variation.<br>notch/drop         0 - None present           Vasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion<br>contour         0 - Acute         1 - Notch in midline           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave           1 - Curved concavity         2 - Obuse-<br>0 - Flat         2 - Onvex           1 - Curved concavity         2 - Angular concavity         2 - Angular concavity           2 - Not present         0 - Not present         0 - Flat           1 - Curved concavity         2 - Angular concavity         2 - Angular concavity           2 - Marked angular concavity         2 - Angular concavity         2 - Angular concavity           2 - Marked angular concavity         2 - Marked angular concavity, with a convex area           0 - Not present         0 - Not present         0 - Upturned           1 - Curved         0 - Nore         1 - Straight         0 - Nore           1 - Straight         0  |   |  |   |
| vermillion border         identifiable vermillion lip border with variable coverage.         2 - Full border           Upper/lower lip<br>vermillion midline<br>notch/drop         The presence of different forms of midline variation.         0 - None present         0 - None present           Notch: grooved area (tissue excesss).         0 - None present         0 - None present         0 - None present           Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>columella angle which can be 90 degrees, acute or<br>peaks to the commissures.         0 - Acute         1 - Normal           Upper lip vermillion<br>contour         Despace of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave         1 - Straight           Lower lip-chin shape         Vermillion border to the chin.         0 - Flat         1 - Curved concavity           Lower lip-chin shape         Vermillion border to the chin.         0 - Flat         2 - Angular concavity           Lower lip-chin shape         Vermillion border to the chin.         0 - Not present         0 - Not present           Commissures         Position of the commissures in relation to the general lip         0 - Upturned         1 - Present           Lower lip vermillion         General curvature of the lower lip.         1 - Straight         2 - Convek           Commissures         Inne.         2 - Downturned         1 - Straight           <  |   |  |   |
| Upper/lower lip<br>vermilion midline<br>notch/drop         The presence of different forms of midline variation.<br>Notch: grooved area (tissue deficiency); Drop: bumped<br>area (tissue excesss).         0 - None present           Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave           Upper lip-chin shape         The curvature of the sub lip area, from the lower lip<br>vermillion border to the chin.         0 - Flat           Lower lip-chin shape         Presence of an obvious mental fold.         0 - Not present           Pronounced mentalis<br>fold         Presence of an obvious mental fold.         0 - Not present           Output red         0 - Not present         0 - Not present           Lower lip-chin shape         Ine.         0 - Not present           Commissures         Position of the commissures in relation to the general lipi         1 - Straight           Lower lip vermillion<br>contour         General curvature of the lower lip.         0 - Norne           0 - Norne         1 - Straight         2 - Ownturned           1 - Straight         2 - Ownturned         1 - Straight           1 - Norex         2 - Singht         2 - Singht   |   |  |   |
| Upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.<br>Notch: grooved area (tissue deficiency); trop: bumped<br>area (tissue excesss).         1 - Notch in midline           Nasolabial Angle         area (tissue excesss).         3 - Droopy midline           Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion<br>contour         0 - Soreave         1 - Normal           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave           1         The curvature of the sub lip area, from the lower lip.         0 - Flat           1         - Curved concavity         2 - Angular concavity           2         - Not present         0 - Uptured           1         Presence of an obvious mental fold.         1 - Present           1         - Nortered         1 - Straight           1         - Not present         0 - Upturned           1         - Droop midline         1 - Straight           1         - Not present         0 - Upturned           1         - Droop midline         1 - Straight           1         - Downturned         1 - Straight           1         - Downturned         1 - Straight           1  | vermillion border   | Identifiable vermillion lip border with variable coverage.   | 2 - Full border   |
| Upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.<br>Notch: grooved area (tissue deficiency); trop: bumped<br>area (tissue excesss).         1 - Notch in midline           Nasolabial Angle         area (tissue excesss).         3 - Droopy midline           Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion<br>contour         0 - Soreave         1 - Normal           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave           1         The curvature of the sub lip area, from the lower lip.         0 - Flat           1         - Curved concavity         2 - Angular concavity           2         - Not present         0 - Uptured           1         Presence of an obvious mental fold.         1 - Present           1         - Nortered         1 - Straight           1         - Not present         0 - Upturned           1         - Droop midline         1 - Straight           1         - Not present         0 - Upturned           1         - Droop midline         1 - Straight           1         - Downturned         1 - Straight           1         - Downturned         1 - Straight           1  |   |  |   |
| Upper/lower lip<br>vermillion midline         The presence of different forms of midline variation.<br>Notch: grooved area (tissue deficiency); trop: bumped<br>area (tissue excesss).         1 - Notch in midline           Nasolabial Angle         area (tissue excesss).         3 - Droopy midline           Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion<br>contour         0 - Soreave         1 - Normal           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave           1         The curvature of the sub lip area, from the lower lip.         0 - Flat           1         - Curved concavity         2 - Angular concavity           2         - Not present         0 - Uptured           1         Presence of an obvious mental fold.         1 - Present           1         - Nortered         1 - Straight           1         - Not present         0 - Upturned           1         - Droop midline         1 - Straight           1         - Not present         0 - Upturned           1         - Droop midline         1 - Straight           1         - Downturned         1 - Straight           1         - Downturned         1 - Straight           1  |   |  |   |
| vermillion midline<br>notch/drop         Notch: grooved area (tissue excess).         2 - Bunched mass in midline           notch/drop         area (tissue excess).         3 - Droopy midline           Nasolabial Angle         0 - Acute         1 - Normal           Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute         1 - Normal           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's box         2 - Convase           2 - Convasition         2 - Convasition         2 - Convasition           Upper lip vermillion<br>contour         peaks to the commissures.         3 - Pseudo-convex           1 - Curved concavity         2 - Anglard angular concavity         2 - Anglard angular concavity           Lower lip-chin shape         vermillion border to the chin.         0 - Not present           Pronounced mentalis<br>fold         Presence of an obvious mental fold.         1 - Present           Lower lip vermillion<br>fold         Presence of an obvious mental fold.         1 - Straight           Lower lip vermillion<br>fold         Presence of an obvious mental fold.         1 - Straight           Lower lip vermillion<br>fold         Presence of an obvious mental fold.         1 - Straight           Lower lip vermillion         1 - Straight         2 - Convex           Lower lip vermillion         1 - Straight         2  |   |  |   |
| notch/drop         area (tissue excess).         3 - Droopy midline           Nasolabial Angle         Columelia angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute           Upper lip vermillion         0 - Concave         1 - Straight           Upper lip vermillion         The shape of the vermillion border from the Cupid's bow         2 - Convex           contour         peaks to the commissures.         3 - Pseudo-convex           Lower lip-chin shape         vermillion border to the chin.         6 - Flat           1 - Curved concavity         3 - Marked angular concavity           Lower lip-chin shape         vermillion border to the chin.         4 - Marked angular concavity           Pronounced mentalis<br>fold         Presence of an obvious mental fold.         1 - Present           Commissures         Position of the commissures in relation to the general lip         0 - Upturned           Lower lip vermillion         Ine.         0 - Not present           Lower lip vermillion         Ine.         0 - Upturned           Commissures         0 - Straight         0 - Upturned           Lower lip vermillion         Ine.         0 - Nortow in midline           1 - Straight         2 - Downturned         0 - Upturned           Lower lip vermillion         Ine.         0 - Narrow in midline  |   |  |   |
| Nasolabial Angle         Columella angle which can be 90 degrees, acute or<br>obtuse.         0 - Acute<br>1 - Normal           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Concave<br>1 - Straight           Upper lip vermillion<br>contour         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 - Flat           1 - Curved concavity         2 - Angular concavity           2 - Angular concavity         3 - Marked angular concavity           2 - Marked angular concavity.         4 - Marked angular concavity.           4 - Marked angular concavity.         3 - Noresent           1 - Present         0 - Upturned           Commissures         0 - Sot present           1 - Present         0 - Upturned           Lower lip vermillion<br>contour         General curvature of the lower lip.           4 - Marked angular concavity.         1 - Straight           Lower lip vermillion<br>contour         General curvature of the lower lip.           4 - Marked/y curved         0 - None           1 - Straight         2 - Convex           2 - Slight         3 - Marked lateral muscular tonicity  |   |  |   |
| Columella angle which can be 90 degrees, acute or<br>Nasolabial Angle         1 · Normal           Nasolabial Angle         obtuse.         2 · Obtuse           Upper lip vermillion<br>contour         Angue of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 · Concave<br>1 · Straight           Upper lip vermillion<br>contour         peaks to the commissures.         0 · Flat           1 · Curved concavity         0 · Flat           1 · Curved concavity         0 · Angular concavity           2 · Angular concavity         0 · Not present           1 · Outreed concavity         0 · Not present           1 · Curved concavity         0 · Not present           1 · Outreed         0 · Not present           1 · Outreed         0 · Not present           1 · Deverning         0 · Upturned           1 · Deverning         0 · Upturned           1 · Deverning         0 · Narrow in midline           1 · Deverning         1 · Straight           1 · Deverning         0 · Narrow in midline           1 · Deverning         0 · Narrow in midline           1 · Curved         0 · Nore           1 · Convex         2 · Slight  | notch/drop  | area (tissue excesss).   | 3 – Droopy midline                                      |
| Columella angle which can be 90 degrees, acute or<br>Nasolabial Angle         1 · Normal           Nasolabial Angle         obtuse.         2 · Obtuse           Upper lip vermillion<br>contour         Angue of the vermillion border from the Cupid's bow<br>peaks to the commissures.         0 · Concave<br>1 · Straight           Upper lip vermillion<br>contour         peaks to the commissures.         0 · Flat           1 · Curved concavity         0 · Flat           1 · Curved concavity         0 · Angular concavity           2 · Angular concavity         0 · Not present           1 · Outreed concavity         0 · Not present           1 · Curved concavity         0 · Not present           1 · Outreed         0 · Not present           1 · Outreed         0 · Not present           1 · Deverning         0 · Upturned           1 · Deverning         0 · Upturned           1 · Deverning         0 · Narrow in midline           1 · Deverning         1 · Straight           1 · Deverning         0 · Narrow in midline           1 · Deverning         0 · Narrow in midline           1 · Curved         0 · Nore           1 · Convex         2 · Slight  |   |  |   |
| Nasolabial Angle         obtuse.         2 - Obtuse           Upper lip vermillion<br>contour         - Concave         - Concave           1 - Straight         - Convex           2 - Convex         - Convex           2 - Convex         - Flat           1 - Curved concavity         - Flat           2 - Angular concavity         - Angular concavity           2 - Angular concavity         - Marked angular concavity           2 - Angular concavity         - Not present           fold         Presence of an obvious mental fold.           1 - Present         - Upturned           Commissures         - Straight           Position of the commissures in relation to the general lip.         - Upturned           Lower lip vermillion         - Straight           Lower lip vermillion         - On Narrow in midline           1 - Straight         - Convex           2 - Curved         - Convex           2 - Slight         - None           1 - Convex  |   |  |   |
| Upper lip vermillion         The shape of the vermillion border from the Cupid's bow<br>contour         0 - Concave<br>1 - Straight           Upper lip vermillion         The shape of the vermillion border from the Cupid's bow<br>peaks to the commissures.         2 - Convex           0 - flat         - flat         - Convex interconcentive<br>2 - Angular concavity           Lower lip-chin shape         vermillion border to the chin.         - flat           Pronounced mentalis<br>fold         Presence of an obvious mental fold.         - Not present           Prosition of the commissures in relation to the general lip<br>line.         0 - Upturned           Commissures         Position of the commissures in relation to the general lip<br>2 - Curved         - Straight           Lower lip vermillion<br>ford         General curvature of the lower lip.         4 - Marked lateral muscular tonicity  | Marcal Marcala  |  |   |
| Upper lip vermillion         1 - Straight           upper lip vermillion         1 - Straight           contour         peaks to the commissures.         2 - Convex           a - Pseudo-convex         a - Pseudo-convex           a - Straight         - Convex           a - Straight         - Straight           a - Straight         - Convex           b - Straight         - Straight           commissures         - Straight           commissures         - Not present           fold         Presence of an obvious mental fold.           a - Straight         - Upturned           commissures         - Upturned           lower lip vermillion         - Straight           contour         General curvature of the lower lip.           a - Straight         - Straight           contour         General curvature of the lower lip.  | Nasolabial Angle  | obtuse.  | 2 - Ootuse  |
| Upper lip vermillion         1 - Straight           upper lip vermillion         1 - Straight           contour         peaks to the commissures.         2 - Convex           a - Pseudo-convex         a - Pseudo-convex           a - Straight         - Convex           a - Straight         - Straight           a - Straight         - Convex           b - Straight         - Straight           commissures         - Straight           commissures         - Not present           fold         Presence of an obvious mental fold.           a - Straight         - Upturned           commissures         - Upturned           lower lip vermillion         - Straight           contour         General curvature of the lower lip.           a - Straight         - Straight           contour         General curvature of the lower lip.  |   |  | 0.000   |
| Upper lip vermillion         The shape of the vermillion border from the Cupid's bow         2 - Convex           contour         peaks to the commissures.         3 - Pseudo-convex           a - Pseudo-convex         3 - Narked angular concavity           a - Marked angular concavity         3 - Narked angular concavity, with a convex area           b - Nore         1 - Present           a - Narcow in midline         1 - Straight           a - Straight         3 - Narkeditareal muscular tonicity  |   |  |   |
| contour         peaks to the commissures.         3 - Pseudo-convex           contour         peaks to the commissures.         3 - Pseudo-convex           0 - Flat         0 - Flat           1 - Curved concavity         2 - Angular concavity           2 - Angular concavity         3 - Marked angular concavity           3 - Marked angular concavity         3 - Marked angular concavity           1 - Or vest         0 - Not present           1 - Or vest         0 - Not present           1 - Straight         0 - Upturned           1 - Straight         1 - Straight           1 - Straight         2 - Downturned           1 - Straight         2 - Curved           1 - Straight         2 - Curved           2 - Onvex         2 - Curved           2 - Curved         2 - Curved           2 - Slight         3 - Marked lateral muscular tonicity   | the second se | The share of the upper illing band of the state of the st |   |
| Lower lip-chin shape     0 - flat       Interpretent of the sub lip area, from the lower lip     3 - Marked angular concavity       Interpretent of the sub lip area, from the lower lip     3 - Marked angular concavity       Interpretent of the sub lip area, from the lower lip     9 - Not present       Interpretent of the commissures in relation to the general lip     0 - Not present       Interpretent of the commissures in relation to the general lip     1 - Straight       Interpretent of the lower lip.     1 - Straight       Lower lip vermillion contor     General curvature of the lower lip.       Interpretent of the lower lip.     4 - Marked lateral muscular tonicity  |   |  |   |
| Lower lip-chin shape vermillion border to the chin.  | contour   | peaks to the commissures.  | 3 = PSEUDO-CONVEX                                       |
| Lower lip-chin shape vermillion border to the chin.  |   |  | Q Flat  |
| Lower lip-chin shape         2 - Angular concavity           Intercurvature of the sub lip area, from the lower lip         3 - Marked angular concavity           Pronounced mentalis         0 - Not present           fold         Presence of an obvious mental fold.         0 - Not present           Commissures         0 - Upturned         0 - Upturned           Commissures         0 - Upturned         0 - Upturned           Lower lip vermillion         1 - Straight         0 - Unrow in midline           Lower lip vermillion         0 - Narrow in midline         1 - Straight           Lower lip vermillion         0 - Narrow in midline         1 - Straight           Lower lip vermillion         0 - Narrow in midline         1 - Straight           Lower lip vermillion         0 - Narrow in midline         1 - Straight           Lower lip vermillion         0 - Narrow in midline         1 - Straight           Lower lip vermillion         0 - Narrow in midline         1 - Straight           Lower lip vermillion         2 - Curved         1 - Convex           2 - Slight         3 - Marked lateral muscular tonicity  |   |  |   |
| The curvature of the sub lip area, from the lower lip         3 - Marked angular concavity           Lower lip-chin shape         vermillion border to the chin.         4 - Marked angular concavity, with a convex area           Pronounced mentalis<br>fold         Presence of an obvious mental fold.         0 - Not present           Commissures         Presence of an obvious mental fold.         1 - Present           Commissures         Position of the commissures in relation to the general lip         1 - Straight           Lower lip vermillion         2 - Downturned         2 - Downturned           Lower lip vermillion         6 - Not present         2 - Curved           Contour         General curvature of the lower lip.         4 - Markedly curved           1 - Straight         2 - Curved         2 - Curved           Contour         General curvature of the lower lip.         4 - Markedly curved           1 - Convex         2 - Slight         3 - Marked lateral muscular tonicity   |   |  |   |
| Lower lip-chin shape         vermillion border to the chin.         4 - Marked angular concavity, with a convex area           Pronounced mentalis<br>fold         0 - Not present         0 - Not present           fold         Presence of an obvious mental fold.         1 - Present           Commissures         0 - Upturned         0 - Upturned           Position of the commissures in relation to the general lip         1 - Straight         0 - Upturned           Lower lip vermillion         1 - Straight         1 - Straight           Lower lip vermillion         General curvature of the lower lip.         4 - Markedly curved           Contour         General curvature of the lower lip.         0 - None           1 - Straight         2 - Convex         2 - Slight           3 - Marked lateral muscular tonicity         3 - Marked lateral muscular tonicity   |   | The construct of the cub line area from the lawseline  | ×   |
| Pronounced mentalis<br>fold         0 - Not present           fold         Presence of an obvious mental fold.         1 - Present           0 - Upturned         0 - Upturned           Commissures         0 - Upturned           Position of the commissures in relation to the general lip         1 - Straight           Lower lip vermillion<br>contour         0 - Narrow in midline           2 - Curved         2 - Curved           2 - Curved         2 - Curved           2 - Slight         3 - Marked lateral muscular tonicity  | Louise line ship shares   |  |   |
| fold         Presence of an obvious mental fold.         1 - Present           Commissures         0 - Upturned         0 - Upturned           Inne.         2 - Downturned           Lower lip vermillion         0 - Narrow in midline           contour         General curvature of the lower lip.         4 - Markedly curved           0 - None         1 - Convex           2 - Slight         3 - Marked lateral muscular tonicity   |   | verminion border to the chin.  |   |
| Commissures         Position of the commissures in relation to the general lip<br>line.         0 - Upturned           1 - Straight         1 - Straight           2 - Downturned         0 - Narrow in midline           1 - Straight         2 - Curved           contour         General curvature of the lower lip.         4 - Markedly curved           0 - None         1 - Convex           2 - Slight         3 - Marked lateral muscular tonicity  |   | Processo of an obvious monthl fold   |   |
| Commissures         Position of the commissures in relation to the general lip         1 - Straight           Ine.         2 - Downturned           2 - Downturned         - Narrow in midline           Lower lip vermillion         - Straight           contour         General curvature of the lower lip.           4 - Markedly curved         - None           1 - Convex         - Sight           2 - Slight         - Sight           3 - Marked lateral muscular tonicity         - Sight   | 1010  | Presence of an opvious mental fold.  | A - PRORING   |
| Commissures         Position of the commissures in relation to the general lip         1 - Straight           Ine.         2 - Downturned           2 - Downturned         - Narrow in midline           Lower lip vermillion         - Straight           contour         General curvature of the lower lip.           4 - Markedly curved         - None           1 - Convex         - Sight           2 - Slight         - Sight           3 - Marked lateral muscular tonicity         - Sight   |   |  | 0 - Lietureed   |
| Lower lip vermillion Contour General curvature of the lower lip.  General curvature of the lower lip.  Contour curvature durvature General curvature of the lower lip.  Contour curvature durvature  | Commission  | Desition of the complexity in this to the  |   |
| Lower lip vermillion contour General curvature of the lower lip.  General curvature of the lower lip.  O - Naree  - Curved - Curved - Markedly curved - None - None - Solution -   | Commissures   |  |   |
| Lower lip vermillion contour General curvature of the lower lip.  General curvature of the lower lip.  General curvature of the lower lip.  A- Markedly curved  O- None  - Convex  - Slight  - Slight  - Marked lateral muscular tonicity  |   | une.   |   |
| Lower lip vermillion Contour General curvature of the lower lip.  Contour General curvature of the lower lip.  Contour   |   |  |   |
| contour General curvature of the lower lip. 4 - Markedly curved<br>0 - None<br>1 - Convex<br>2 - Slight<br>3 - Marked lateral muscular tonicity  | Louise lie were the   |  |   |
| 0 - None<br>1 - Convex<br>2 - Slight<br>3 - Marked lateral muscular tonicity   |   | Concept and the state of the lower life  |   |
| 1 - Convex<br>2 - Slight<br>3 - Marked lateral muscular tonicity   | contour   | General curvature of the lower lip.  |   |
| 2 - Slight<br>3 - Marked lateral muscular tonicity   |   |  |   |
| 3 - Marked lateral muscular tonicity   |   |  |   |
|  |   |  |   |
| Lower lip tone   The assessment of the mentalis muscle tone.  4 - Marked tonicity with bumped areas  | the second second   |  |   |
|  | Lower lip tone  | The assessment of the mentalis muscle tone.  | 9 - Marked tonicity with bumped areas                   |

Figure 2: Description of morphological traits.

## Method

The author (SH) received a training package on the WRCT scoring system from its developer CW. This involved reviewing threedimensional scans of an initial 45 patient sample that both examiners CW and SH scored independently. The resultant scores were then compared and the rationale for the respective WRCT classification ascertained and discussed. (Should I include the results of the initial calibration tests? - yes) Once both examiners were content that SH was proficient in the utilisation of the WRCT a random study sample was then selected. Forty randomly selected three-dimensional facial scans were obtained from the Avon Longitudinal Study of Parents and Children (ALSPAC) [14]. Since 2006/2007 the ALSPAC study sample have been recalled and three-dimensional cans have been undertaken using Konica Minolta Vivid 900 laser scanners [15,16]. The data collected from these three-dimensional laser scans had been proven reliable and reported extensively in the literature [17,18] The

forty, three-dimensional scans were imported into Geomagic Qualify 10 (a reverse engineering software package), where the image was processed and viewed using the grey undertexture, this was found to highlight the morphological Features [in my paper, and also I'm writing a paper with Jelena highlighting this - but this article will probably get published before that one!) (need reference for need of grey skin tone). The software allowed 3600 rotation of the facial scan and provided the ability to select specific viewpoints from which each morphological feature could be scored against the WRCT. The author used six standardised views of each individual in the study sample upon which to conduct the WRCT assessment (Figure 3) The facial scans were reviewed and the lip traits were scored against the WRCT. The two examiners reviewed the calibration data independently and the inter-examiner error was then calculated (Table 1). Intraexaminer assessment (SH) of agreement was undertaken with a oneweek interval between WRCT data assessment time points (Table 2).

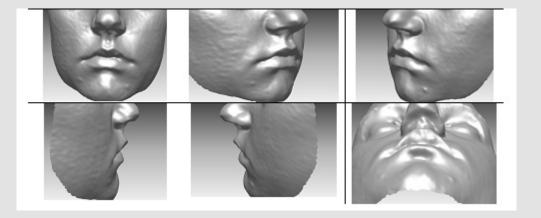


Figure 3: An example of the standardised views of the 3600 laser scan used.

#### Table 1: Intra-examiner agreement.

|                          | Intra-examiner agreement % |                          | Intra-examiner agreement % |
|--------------------------|----------------------------|--------------------------|----------------------------|
| Upper lip                |                            | Lower lip                |                            |
| Philtrum shape           | 90                         | Vermillion fullness      | 90                         |
| Philtrum width           | 95                         | Vermillion border        | 88                         |
| Cupid's bow              | 90                         | Double vermillion border | 98                         |
| Vermillion fullness      | 80                         | Vermillion brim          | 88                         |
| Vermillion border        | 88                         | Vermillion groove/notch  | 78                         |
| Double vermillion border | 93                         | Lip-chin shape           | 78                         |
| Vermillion brim          | 93                         | Mentalis fold            | 93                         |
| Vermillion groove/drop   | 85                         | Commisures               | 83                         |
| Contour                  | 85                         | Vermillion contour       | 70                         |
| Nasio-labial angle       | 93                         | Lower lip tone           | 78                         |

|                          | Inter-examiner agreement % |                          | Inter-examiner agreement % |
|--------------------------|----------------------------|--------------------------|----------------------------|
| Upper lip                |                            | Lower lip                |                            |
| Philtrum shape           | 85                         | Vermillion fullness      | 85                         |
| Philtrum width           | 95                         | Vermillion border        | 80                         |
| Cupid's bow              | 88                         | Double vermillion border | 100                        |
| Vermillion fullness      | 80                         | Vermillion brim          | 85                         |
| Vermillion border        | 83                         | Vermllion groove/notch   | 75                         |
| Double vermillion border | 93                         | Lip-chin shape           | 73                         |
| Vermillion brim          | 83                         | Mentalis fold            | 85                         |
| Vermillion groove/drop   | 75                         | Commisures               | 83                         |
| Contour                  | 83                         | Vermillion contour       | 70                         |
| Nasio-labial angle       | 78                         | Lower lip tone           | 83                         |

Table 2: Inter-examiner agreement.

## **Statistical Analysis**

The inter and intra-examiner agreement was calculated for each trait by evaluating the percentage agreement between the respective scores.

#### Results

The three-dimensional facial scans were reviewed for the forty randomly selected facial scans. The results for the percentage intraand inter-examiner reliability calculations are outlined in tables 1 & 2 respectively. As was expected in almost all of the WRCT categories the intra-examiner reliability was greater than inter-examiner reliability. The only exceptions to this were the lower vermillion double lower border and the lower lip tone. The highest agreement in the intraexaminer group and inter-examiner group were the lower double vermillion border category and the philtrum width. The lowest categories in the intra-examiner and the inter-examiner group were the lower vermillion contour and lip-chin shape.

#### Discussion

Wilson, et al. [10] in the development of the classification tool highlighted the considerable variation in normal lip morphology and in the development of a visual/numerical tool has provided a method of classifying and identifying trends in these phenotypical traits. Wilson et al10 reported a high level of agreement between inter and intra examiner reliability with respect to most aspects of the WRCT. However, they highlighted that the least reliable aspect was the assessment of the lower lip vermillion contour. In their research they found the intra and inter examiner reliability to be 79% and 33% respectively. They recommended dichotomisation of the lower lip results in order to improve reliability (90% inter-examiner and 67% intra examiner respectively). Whilst in the author's experience this aspect of the WRCT did prove the most difficult aspect in which to achieve calibration, the results of this study showed that a high

level of agreement (70% inter and intra-examiner agreement) could be achieved and that dichotomisation of this aspect of the WRCT may not be required. This could potentially be due to the fact that the author had a more comprehensive training package or because the use of this tool had matured since its development and consequently the author received better training from the developers in its use. The morphological appearance, trends and associations of this study sample are not reported here as they have already been reported in the much larger study undertaken by Wilson et al10. But more importantly this study has shown that an examiner new to the WRCT can calibrate and utilise this tool to assess a series of scanned images from a study population in order to classify the individuals according to the morphological appearance of their lips. This type of analysis would not have been possible by the more traditional land marking techniques, where the subtleties of the lip contours, grooves and indentations are ignored, with the preference for exact measurements with small margins of error. This detailed examination of the topography of the lips afforded by the WRCT provides a unique insight into lip morphology (and can be likened to a detailed Admiralty chart of the ocean bed or that of hill contours on an Ordanance survey map). It is the aspiration of the authors that this tool will allow a detailed insight into the soft tissue characteristics of different ethnic populations and the potential identification of changes due to growth of a key aspect of the oral soft tissue environment for many medical specialties.

# Conclusion

This study has shown that the Wilson-Richmond Categorisation Tool is a reproducible and reliable method of assessing the various morphological features of the lips. This tool has been developed on epidemiological data and shows both good inter and intra-examiner reliability. The Wilson-Richmond Categorisation Tool can provide a standardised means of assessment by which further comparisons amongst different, growing, ethnic groups may be compared with a view to identifying population associations. The second paper in this series utilises the WRCT to assess the morphological characteristics of two different ethnic populations of 12-year-old school children.

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## **Conflict of Interest**

The authors declare no conflict of interest.

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